MEMORANDUM

Pls let me know if you have comments 5-4430

CAMP DRESSER & McKEE INC.

Superfund Records Center
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TO: Distribution

FROM: Stephen Hickox - CDM

SUBJECT: City of New Bedford - Facilities Plan
Technical Meeting on Tuesday, July 14, 1987

DATE: July 10, 1987

As you know, our next Technical Meeting is on Tuesday, July 14, 1987 at 1:30 p.m. at CDM's fifth floor conference room. I suggest the following agenda:

1. Discussion on project flows
2. Discussion/finalization of receiving water modeling program
   a. Models to be used
   b. Field program required
3. Topics for next meeting

Please find enclosed a draft copy of the flow chapter for your review prior to Tuesday's meeting.

Distribution:

DEQE - Ron Lyberger, Alan Slater (2), Larry Gil
EPA - Wlater Newman, Ed Dettman
CLF - Paul Hauge
CDM - Jim Small, Pat Hughes, Howie Yamaguchi, Dave Noonan

SJH/ph
File: 309-136-RT-GRIT/28

7-10-87

DRAFT

INTERIM REPORT

ON

FLOWS

City of New Bedford, Massachusetts

1.0 INTRODUCTION

1.1 GENERAL

The wastewaters and associated pollutants received at the New Bedford treatment facilities originate from a wide variety of complex sources which include domestic wastewater from residential activities and non-domestic wastewaters from the commercial, industrial and other business activities of the region. In addition, the facilities receive extraneous water through infiltration and inflow which enter pipes through leaks and cracks due to age, condition, and location of the more than 200 miles of sewer pipe tributary to the treatment system. During rainstorms, the plant receives combined sewage flow that results from the mixing of sewage and urban stormwater runoff. The plant also receives septage which is pumped from septic systems in the unsewered areas of New Bedford, Acushnet, Dartmouth, Fairhaven and Mattapoisett.

Presently, the City of New Bedford owns and operates a primary wastewater treatment plant at the southern tip of Clarks Point. The existing plant was constructed in 1972 and was designed for an average capacity of 30 mgd. Treatment consists of grit removal, primary clarification, and chlorination processes and once treated, the wastewater is discharged through two outfalls to Buzzards Bay.

In preparing estimates of flows and loads to the treatment plant, each of these components has been considered separately as they effect both the volume of wastewater expressed in millions of gallon per day and the quantity of pollutants expressed in pounds per day. Later sections of this report present the detailed approach to estimating these variables over the planning period. The remainder of this section sets forth the service district and the planning period for which these estimates have been prepared.

1.2 SERVICE AREA

Under the existing intermunicipal agreements, the City of New Bedford is charged with providing treatment to the wastewaters generated within the City of New Bedford as well as small sections of the Towns of Dartmouth and Acushnet. The present sewer service area for the New Bedford treatment facility encompasses an area of approximately 11.5 square miles with a tributary population of approximately 95,713 which includes the sewered population from all three communities.

TABLE 1-1

Existing Sewer Service Area

MAKE SEPARATE PAGE

	1985 Census (sq. mi.)	Current Service Population
New Bedford	10.75	93,233
Dartmouth	0.6	2,280
Acushnet	0.2	200
TOTAL	11.5	95,713

If the service area is expanded, it will occur at the boundaries of the existing service area which is shown in Figure 1-1. This service area was used as a base for developing population and flow projections.

Table 1-1, attached, shows a breakdown of the existing service area for the different community contribution~~s~~.

1.3 PLANNING PERIOD

The planning period used in this report encompasses the period from now through the year 2020. This represents the first twenty years of operation of the secondary plant which has been targeted to be in operation not later than the end of 1997 by the federal count. The use of 20-year planning periods is considered a generally acceptable practice in the profession and is required by facilities planning regulations issued by the U. S. Environmental Protection Agency (EPA).

The 20-year planning period through the year 2020 represents a change from earlier planning for secondary treatment in New Bedford. The earlier work used a 40-year planning period which ended in 2020 and was based on a start date for facilities operation of 1980. As will be seen later, this change in the planning period results in only a minor difference in overall estimates of flows and loads, essentially because of the relative stable nature of the New Bedford area demographics and economy. It is also expected that the expansion of the existing sewer service area will be relatively limited.

2.0 FLOW ESTIMATES

2.1 GENERAL

The volume of wastewater produced in the New Bedford service area is directly related to three factors:

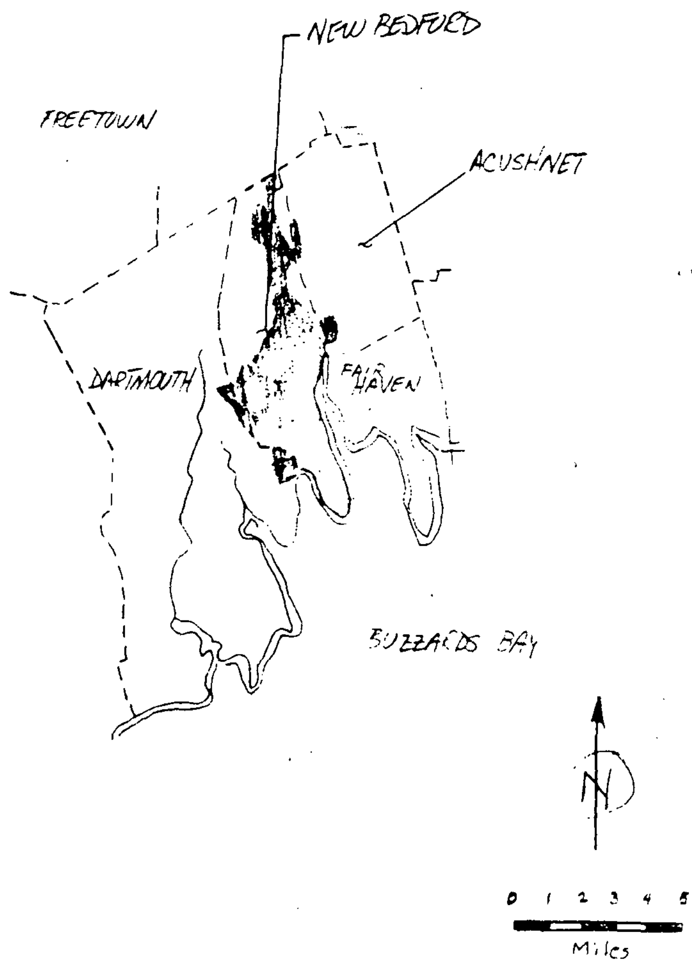


Figure 1-1

Existing Sewer Service Area

- the population of the service area and the water consumed by the residents and returned to the sewer system,

- the economic activity which takes place within the service area and the wastewaters discharged as a result of manufacturing and employee usage and,

- the rainfall in the service area, which enters the sewer system in two manners: one as infiltration/inflow (through leaks and cracks in sewers and through surface and subsurface drains) or as direct stormwater runoff.

Projections through the year 2020 for each of these sources of wastewater flows are discussed in the following sections.

2.2 POPULATION

The volume of domestic wastewater produced is a function of the population of the service area, the water consumption patterns of the residents, and the amount of water consumed which is returned to the sewer system.

2.2.1 POPULATION PROJECTIONS

Population projections have been carried into the year 2020 in order to meet the planning period needs. The following provides a description of preliminary information and assumptions required for developing projections.

Existing and Future Total ~~Population~~ and Sewered Population

Total 1985, 1995 and 2020 population estimates are shown in Table 2-1 for the City of New Bedford and the Towns of Dartmouth and Acushnet. Both population changes and projected extension of the sewer systems are incorporated in the sewered population projections for future years.

Methodologies For Population Forecasting

Most population forecasting models study past trends of growth and extrapolate these trends into the future. These models assume that the future population of a community reflects past growth of that community, past growth of some other community, or growth of the region. The true causes of these past trends in population change are due to natural change and migration. Natural change is composed of births and deaths. Migration reflects the effect of individuals moving into an area less the number moving out of the area.

TABLE 2-1

POPULATIONS FOR SERVICE AREA COMMUNITIES

Total Populations	1985(1)	1995(2)	2020(3)
New Bedfoprd	96,553	109,630	120,000
Dartmouth	24,843	26,345	30,100
Acushnet	8,772	9,334	10,700
TOTAL:	130,148	145,309	160,800
Sewer Service Area Populations			
New Bedford	93,233	106,000	120,000
Dartmouth	2,280	2,300	2,300
Acushnet	200	1,000	2,280
TOTAL:	95,713	109,300	124,560

(1) As estimated by Massachusetts Census Department
(2) As estimated by MISER in Provisional Populations Projections, 1986
(3) Extrapolated from 1995 Projections and Saturation Information

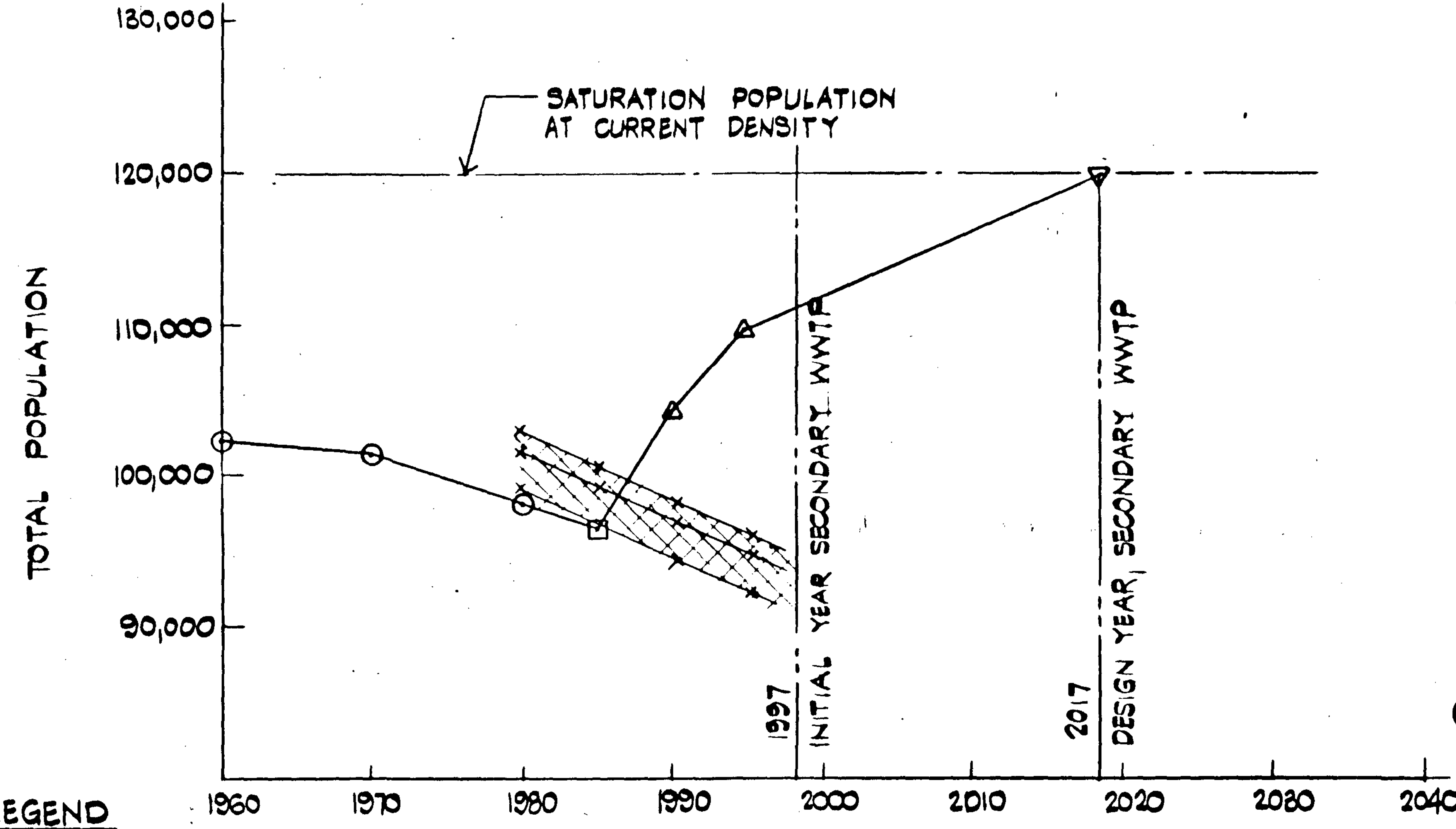
2.2.2 POPULATION PROJECTION SOURCES

The population projections adopted for this report are based upon projections made by the Massachusetts Institute for Social and Economic Research (MISER) at the State Data Center at the University of Massachusetts at Amherst as well as the Population Report done by the City of New Bedford Planning Department. Since 1972, MISER has prepared population projections for all commonwealth communities which are updated annually. They represent the only area-wide population forecast developed in recent years as such they have become accepted statewide. The MISER forecast has been published in a document entitled "Provisional Population Projections" and is recognized by the Southeast Regional Planning and Economic Development District (SERPEDD) as the official regional population projections. The most recent projections were developed in 1986 and extend to years 1990 and 1995. For the City of New Bedford, the population is expected to increase by 13 percent over the 1985 population figure to 109,630 in the year 1995 and to increase by 24 percent over the 1985 total to 120,000 in year 2020. Populations for the Towns of Dartmouth and Acushnet are expected to increase by 6 percent over the 1985 total to 26,345 and 9,334, respectively in the year 1995. By year 2020, the population for Dartmouth and Acushnet are expected to increase by 21 percent over the 1985 totals to 30,100 and 10,700, respectively.

The other available source for population projections is a report entitled "New Bedford Comprehensive Plan 1980 - 2000, Population Report" which was prepared by the City of New Bedford Planning Office in 1979. Two sources that were used as a basis for the City's 1979 report which included the 1970 U.S. Census of Population and the 1975 City survey. Projections were developed from 1975, which was used as the base year, in five-year intervals to the year 2000. Adjustments were made were for each of three components: Three sets of projections were developed which portray different scenarios of migration rates. The first is called the "low probable" projection which assumes that the population would decline at a continuing post-war rate due principally to out-migration. The second set of projections is called the "medium possible" projection which attributed the projected decline to decreasing fertility rates among women. The final set of projections is called the "high possible" projection. This assumes that there would be a possibility of a change in the current net outflow pattern due to a significant change in growth trends. Table 2-2 reflects the projected range of population for the three scenarios. The City's population projections for 1980 and 1985 compare reasonably to the actual census counts for the same years for the "low probable" projection. However, it is the feeling of the City of New Bedford Planning Office that in light of the recent increase in housing starts, the projections contained in the 1979 study are conservatively low. The MISER projections are consistent with the current estimates of the New Bedford Planning Office.

As such, the MISER projections have been utilized for the planning period for this study.

Figure 2-1, attached, illustrates historical and projected populations for the City of New Bedford.



LEGEND

⊙ US BUREAU OF CENSUS

⊡ MA. DECENNIAL CENSUS

△ SOUTHEAST REGIONAL PLANNING AND ECONOMIC DEVELOPMENT DISTRICT PROJECTION - MISER

▽ CDM PROJECTION

× NEW BEDFORD - CITY PLANNING DEPT.

FIG. 2-1

POPULATIONS - HISTORICAL & PROJECTION FOR THE CITY OF NEW BEDFORD

TABLE 2-2
New Bedford, MA
Population Projections Contained in
1979 Population Report by City Planning Department

MAKE SEPARATE PAGE

Scenario	1980	1985	1990	1995	2000
Low Probable	99,193	97,637	94,844	92,655	89,951
Medium Possible	101,366	99,725	97,209	95,097	92,448
High Possible	102,931	101,345	98,773	96,511	93,770

2.2.2 DOMESTIC WASTEWATER PROJECTIONS

Estimated volumes of domestic wastewater have been prepared using the aggregate population projections and estimated water consumption rates for the domestic sector. This included an analysis of New Bedford's domestic water consumption using actual 1982 - 1986 consumption data. Knowing the present population of New Bedford to be 96,533, the weighted average residential water consumption rate in the service area was estimated to be 64 gpcd. This consumption rate is approximately the same for the connected Dartmouth and Acushnet population.

Of this water consumption rate, typical residential percentage of 85 to 90% is expected to be discharged to the sewer system as domestic wastewater. Since New Bedford represents an urbanized area with limited open space, a percentage of 90% has been used. This yields 58 gallons per capita per day (64 gpcd X 0.90) discharged to the sewer system as domestic wastewater. Using the total sewered population for New Bedford, Dartmouth, and Acushnet of 95,713 from Table 2-1, the present wastewater flow is approximately 5.55 mgd. A small reduction is anticipated in domestic consumption in future years, primarily as a result of plumbing code revisions and conservation efforts. Because the projected reduction in consumption is small, the future per capita consumption used to estimate future domestic wastewater flows from residential sources is assumed to be the same as observed in the 1982 - 1986 data.

Future domestic wastewater flows from the residential sources in the City of New Bedford were estimated by applying per capita wastewater contribution to the population projections summarized earlier. Therefore, the estimated domestic wastewater flow expected from New Bedford residential sources is approximately 6.15 mgd and 6.96 mgd for the years 2000 and 2020 respectively (58 gpcd X 106,000 people and 58 gpcd X 120,000 people).

Projections for both Acushnet and Dartmouth must be added to this figure. Dartmouth flow quotes are based on the 1983 201 Study done by Dartmouth's engineering consultants, Fay, Spofford and Thorndike as well as documents giving additional information requested by the DEQE. Based on a three-year average for the years 1983-1985, domestic flows from Dartmouth have been estimated to be approximately 0.13 mgd. This flow is assumed to be constant through the year 2020. Domestic flows for Acushnet are based on the 1982 Acushnet Facilities Plan report done by Camp Dresser & McKee Inc. The present day domestic flow of 0.01 mgd is expected to increase 0.12 mgd in the year 2000 and to 0.15 mgd in the year 2020.

Therefore, the total estimated domestic wastewater flows for the years 2000 and 2020 for the entire service area which includes the Towns of New Bedford, Acushnet, and Dartmouth are projected to be 6.90 mgd and 7.24 mgd respectively.

2.~~4~~3 NONDOMESTIC WASTEWATER PROJECTIONS

Nondomestic wastewaters are contributed to the New Bedford system from various activities which take place within the service area. These include process wastewaters associated with manufacturing activities, employee-related sanitary wastes, wastes which are incidental to service provided by the business community and institutional wastewaters. Nondomestic wastewater flows are broken down into the following four categories: industrial, commercial, and institutional infiltration/inflow.

2.~~4~~3.1 Industrial Flows

Industrial contributions to the New Bedford System was considered for all three communities.

Industrial flows for the City of New Bedford have been estimated from CDM's 1982 industrial waste survey, updated with current water use information in addition to information obtained from the City's 1987 industrial survey questionnaire. The types of companies included in this category include manufacturing establishments, large institutional users such as hospitals and schools, and large service companies. For planning purposes, wastewater flows from industries were separated into two categories: major water users were defined as those using in excess of 50,000 gpd of water; those using less than 50,000 gpd were defined as other industries. Specific information on projected water demand, peaking factors and waste water quality were obtained for major water users. At the present time, approximately 5.7 mgd of total industrial wastewater is generated within the City of New Bedford.

In order to develop flow projections for the City of New Bedford, it was first assumed that all land undeveloped currently zoned for industrial use would be developed by the year 2020. As a result of proximity from large water courses for cooling water discharge and limiting capacities of water and sewer infrastructure, it was assumed that the major water-consuming industries would not be representative of the projected industrial community at large. They were, therefore, omitted from analysis when projecting the undeveloped industrially-zoned areas. Along these same lines, it was thought that higher sewer use rates associated with the proposed secondary treatment facility would discourage similar large users from moving into the area. A future New Bedford industrial wastewater flow of about 7.5 mgd was obtained for the year 2020. Assuming that the industrial wastewater flow for New Bedford would increase linearly from the present, the flow for the year 2000 is expected to be approximate 6.0 mgd.

Using the same sources for the Towns of Dartmouth and Acushnet as previously used for the residential sector, flow projections could be made based on present-day flows. There are currently no industries within the Town of Dartmouth which are connected to the New Bedford sewer system. For the years 2000 and 2020, however, it is anticipated that Dartmouth will approximate 0.3 mgd and 1.0 mgd, respectively, which are projections anticipated for staged development of the expanding New Bedford/Dartmouth Industrial Park. The Town of Acushnet has a present-day industrial flow of approximately 0.07 mgd which is generated solely by the Acushnet Company. It is anticipated that flows will increase to 0.10 mgd by the year 2000 and remain constant through the year 2020.

The total industrial flow projections from the three communities are 6.4 mgd for the year 2000 and 8.6 mgd for the year 2020.

2.~~4~~3.2 Commercial Flows

Commercial flows were considered for all three contributing communities.

The present wastewater flow from the commercial sector of the City of New Bedford was determined from the amount of total commercial water usage and the number of acres of land currently devoted to commercial use. Assuming that 96% of this area is presently sewered, the same ratio for residential sewer service, and using a 90% return to sewer ratio, commercial wastewater approximates 1.96 mgd. The present commercial flow from the Town of Dartmouth was estimated to be approximately 0.02 mgd which is assumed to be constant through the year 2020.

The Town of Acushnet presently is reported to have no commercial establishments on line, however, a flow of 0.10 mgd is anticipated by the year 2000 which is expected to remain constant through the year 2020.

This results in a present commercial flow of 2.00 mgd and projected flows of 2.14 mgd for the year 2000 and 2.24 mgd for the year 2020.

3

2.~~4~~.3 Infiltration and Inflow

The term infiltration and inflow (I/I) represents the extraneous water which enters the New Bedford sewer system through leaks and cracks in sewer mains and house connections and from connections between drainage devices such as yard drains, roof leaders, catch basins and sump pumps and the sanitary sewers. The volume of I/I which enters the system is significantly influenced by the age and condition of the sewer systems and by rainfall patterns and groundwater elevations. This report contains estimates of existing and future year I/I based on historical data.

A townwide infiltration/inflow study was conducted by Camp Dresser & McKee and summarized in the April 1981 Draft Infiltration/Inflow Report. The total average infiltration/inflow was estimated to be 15.20 mgd. Of this flow, 13.95 mgd is from infiltration sources and 1.28 mgd is due to inflow.

2.3.4 Dry Weather Overflow

As reported in the 1983 Combined Sewer Overflow report, approximately 4.70 mgd is discharged into receiving waters as dry weather overflow. These overflows operate during dry weather due to lack of available sanitary sewers and insufficient sewer capacity. With recommended improvements installed, it is expected that dry weather overflow will be reduced to zero by the year 2000.

~~2.4.4 Other Contributors~~

2.3.5 Institutional

Institutional wastewater contributions originate from government properties such as schools, small hospitals, and the wastewater treatment plant. At the present time, institutional flow is generated solely within the City of New Bedford of the three contributing communities. Based upon analysis of historical water use records, existing institutional flow approximates 0.34 mgd. It is expected to increase to 0.40 mgd by the year 2000 and remain constant through the year 2020.

2.3.6 Tidal Inflow

Leaking tide gate structures presently permit about 1.30 mgd of sea water to flow into the sewer system. This contribution appears to originate only from the City of New Bedford. According to the Combined Sewer Overflow report of 1983 by Camp Dresser & McKee Inc., those recommended improvements should reduce tidal inflow by 50%. Assuming improvements will be implemented by the year 2000, tidal inflow would approximate 0.65 mgd and remain constant through the year 2020.

2.~~3~~ 4 Flow Summary

Table 2-3 represents an verage dry weather wastewater flow summary by flow component and by community for the immediate past, present and projected years through year 2020.

2.~~6~~ 5 Peaking Factors

In order to properly size wastewater conveyance and treatment facilities, it is necessary to consider peak wastewater flows in addition to average wastewater flows. In peaking the flows tributary to the New Bedford wastewater treatment facility, it is necessary to do so on an individual component basis.

For domestic, commercial and institutional flows, the Merrimack Curve was employed as it is generally an accepted method for peaking such flows. It has been estimated that the peak to average day dry weather ratio for domestic, commercial and institutional flows range from 2.6 to 2.7.

Upon review of existing industrial operations, a peaking factor of 3.0 was established.

Industrial operations were reviewed with respect to the following in order to establish a comprehensive industrial peaking factor:

- number of shifts/day
- number of days/week
- number of weeks/year and
- rate of batch discharges

A comprehensive industrial peaking factor of 3.0 was the resultant.

Based on a review of available infiltration/inflow data and treatment plant records, a peaking factor of 2.0 was established. This is not inconsistent with other metropolitan sewer systems.

Tidal inflow and dry weather overflow were considered to be flow components which are reasonably uniform and as such reflect a peaking factor of 1.0. Tidal inflow is dependent only upon tidal level which is reasonably constant and dry weather overflows are so variable that it would be difficult to apply a peaking factor other than 1.0.

A summary of peak dry weather wastewater flows by flow component is reflected in Table 2-4. The table contains peak flows for the past, present and projected years through year 2020.

TABLE 2-3 CITY OF NEW BEDFORD
DRY WEATHER
WASTEWATER FLOW SUMMARY(mgd)

OW COMPONENT	3-YEAR AVERAGE '83-'85	PRESENT	YEAR 2000	YEAR 2020
I. RESIDENTIAL			(1)	(1)
NEW BEDFORD	5.4	5.4	6.5	7.0
DARTMOUTH	0.1	0.1	0.1	0.1
ACUSHNET	.0	0.1	0.2	0.2
SUBTOTAL	5.5	5.6	6.8	7.3
II. COMMERCIAL				
NEW BEDFORD	2.0	2.0	2.1	2.2
DARTMOUTH	.0	.0	.0	.0
ACUSHNET	0.0	0.0	.0	.0
SUBTOTAL	2.0	2.0	2.1	2.2
III. INSTITUTIONAL				
NEW BEDFORD	0.3	0.3	0.4	0.4
DARTMOUTH	0.0	0.0	0.0	0.0
ACUSHNET	0.0	0.0	0.0	0.0
SUBTOTAL	0.3	0.3	0.4	0.4
IV. INDUSTRIAL (2)				
NEW BEDFORD	5.0	5.7	6.0	7.5
DARTMOUTH	0.0	0.0	0.3	1.0
ACUSHNET	0.0	0.1	0.1	0.1
SUBTOTAL	5.0	5.8	6.4	8.6
V. INFILTRATION	(3)			
NEW BEDFORD	13.6	13.6	11.0	11.0
DARTMOUTH	0.4	0.4	0.3	0.3
ACUSHNET	0.0	.0	0.1	0.1
SUBTOTAL	14.0	14.0	11.4	11.4
VI. TIDAL INFLOW (4)				
NEW BEDFORD	1.3	1.3	0.7	0.7
DARTMOUTH	0.0	0.0	0.0	0.0
ACUSHNET	0.0	0.0	0.0	0.0
SUBTOTAL	1.3	1.3	0.7	0.7
VII. DRY WEATHER OVERFLOW	(5)			
NEW BEDFORD	-4.7	-4.7	0.0	0.0
DARTMOUTH	0.0	0.0	0.0	0.0
ACUSHNET	0.0	0.0	0.0	0.0
SUBTOTAL	-4.7	-4.7	0.0	0.0
TOTAL	23.4	24.3	27.8	30.6

(1) Projected by extending SERPEDD approved MISER population projections.
(2) From staged develoment of expanded New Bedford/Dartmouth Industrial Park.
(3) Projected I/I removal of approximately 20 % resulting from SSES and system rehabilitation.
(4) Resulting from leaking tide gate structures; to be reduced by 50%.
(5) Based on observations at overflow structures during dry weather; to be eliminated.

6-87

TABLE 2-4 CITY OF NEW BEDFORD
PEAK DRY WEATHER
WASTEWATER FLOW SUMMARY (mgd)

FLOW COMPONENT	3-YEAR AVERAGE '83-'85	PRESENT	YEAR 2000	YEAR 2020
RESIDENTIAL COMMERCIAL AND INSTITUTIONAL	7.8	7.9	9.3	9.9
PEAKING FACTOR (1)	2.7	2.7	2.6	2.6
PEAK RES'L, COMM'L AND INST'L FLOW	21.1	21.3	24.2	25.7
INDUSTRIAL	5.0	5.8	6.4	8.6
PEAKING FACTOR (2)	3.0	3.0	3.0	3.0
PEAK INDUST'L FLOW	15.0	17.4	19.2	25.8
INFILTRATION	14.0	14.0	11.4	11.4
PEAKING FACTOR (3)	2.0	2.0	2.0	2.0
PEAK I/I	28.0	28.0	22.7	22.8
TIDAL INFLOW	1.3	1.3	0.7	0.7
PEAKING FACTOR	1.0	1.0	1.0	1.0
PEAK TIDAL INFLOW	1.3	1.3	0.7	0.7
DRY WEATHER OVERFLOW	-4.7	-4.7	0.0	0.0
PEAKING FACTOR	1.0	1.0	1.0	1.0
PEAK DWO	-4.7	-4.7	0.0	0.0
~~TOTAL~~	~~60.7~~	~~63.3~~	~~66.8~~	~~75.0~~

(1) FROM MERRIMACK CURVE.
(2) BASED UPON CURRENT UPDATE OF 1983 CDM INDUSTRIAL WASTE SURVEY.
(3) BASED UPON HISTORICAL PEAKING FACTORSFOR INFILTRATION/INFLOW.

6/24/86

New Bedford – Round 4

Ron Lyberger } DEQE
Alan Slater }

Gwen Ruta }
Edie Goldman } EPA
George Harding }

Ron – trying to ensure that work done will adress all EIS issues, if EIS is needed later.

- Any problem w/ doing EIS in 3 mo. period after production of EIR

Gwen – potential problems
- 1) Leaving scoping decision until later may result in wasted effort, confusion delays.
2) If CDM does ~~[illegible]~~ inadequate job on EIR, would have to supplement it a~~fter~~ submitted.

Ron – possible positions
1) Let's bite the bullet, ~~stop no~~ start EIS now
2) Ron didn't know EPA has a drop-dead date for starting EIS; start EIS process when site screening done, rather than when Phase I done.

Gwen – WQB doesn't feel current info would support a decision re: whether to do an EIS, won't have the info until screening done.

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

One Center Plaza
Boston, Massachusetts 02108
617 742-5151

June 23, 1987

Mr. Alan Slater
Department of Environmental
Quality Engineering
Division of Water Pollution Control
One Winter Street
Boston, MA 02108

City of New Bedford
Phase II WWTP/CSO Facilities Plan
Receiving Water Impact Assessment

Dear Mr. Slater:

We are re-submitting our Receiving Water Impact Assessment proposals of June 11, incorporating the comments and suggestions aired at the meeting on the same date. Please note that we are currently compiling the available raw data from our old 301(h) studies and from other sources. The data will be submitted under separate cover upon completion of the collection exercise.

1. OUTFALL SITING ASSESSMENT

i) Site Selection

As agreed in previous meetings, CDM will first consider the pair of sites comprising the existing New Bedford ocean outfall site and the site proposed under the 301(h) Waiver Applications. (Both documents proposed the same site, but with different diffuser lengths at the end of the pipe.) If the two sites are deemed incapable of meeting the relevant water quality criteria, alternate sites with superior mixing and flushing potential will be selected.

ii) Near-field Water Quality Criteria

Based on the already copious data available through the 301(h) Waiver Applications and work by other agencies, an estimate of the hydraulic conditions at the Zone of Initial Dilution (ZID) can be made at the priority sites for assumed diffuser design configurations. Estimates of initial dilution for proposed diffuser configurations will be made using the EPA mode ls ULINE and UDKHDEN. Initial dilutions thus obtained will be applied to estimated priority pollutant concentrations in the secondary effluent to determine whether the EPA "Gold Book" criteria can be met at the ZID. It is CDM's understanding that if the criteria can be met at the ZID, the same criteria will be assumed to have been met in the far field as well (letter from Thomas McMahon of DEQE to Michael Gritzuk of MWRA dated May 15, 1987).

iii) Far-field Water Quality Assessment

If the investigations concerning the ZID indicate a need for modeling far-field toxicant transport, an appropriate model must be selected. It has become apparent from conversations with Dr. Rocky Geyer, Woods Hole Oceanographic Institute (WHOI) oceanographer, that most of the available oceanographic data in the area of interest were collected in connection with the New Bedford 301(h) Waiver Applications and the Superfund (Battelle) modeling project. These data have been incorporated in both model development projects described below for New Bedford Harbor and its environs.

A recent modeling effort by the consulting firm ASA has also come to CDM's attention. This project was undertaken on behalf of the attorneys representing Aerovox Corporation in the ongoing litigation over New Bedford Harbor. The result was the creation and operation of a two-dimensional, vertically averaged, finite element model of New Bedford Harbor. The model extends from the Acushnet Estuary to the proposed 301(h) outfall site. If this model is available for general use in the Outfall Siting and CSO Facilities Plan projects, it will provide a viable alternative to the use of the Battelle model for far-field assessment. Grid densities around the existing and proposed outfall sites will be refined. This model is further described in Section 2, "CSO Assessment".

In the event that modeling is required, it is CDM's opinion that the hydrodynamics portion of Battelle's New Bedford model and the ASA model (should it be available) provide the most promising alternatives. The Battelle model could be run for several simulation days for a selected critical design conditions. A particle tracking mechanism, such as CDM's PACE, will be operated on the output from the Battelle hydrodynamics runs. Estimated cost per run for the Battelle hydrodynamics portion alone is $5,000 to $7000, depending on whether or not the runs can be made under the auspices of the Environmental Protection Agency.

Alternatively, the ASA model could be run and particles tracked by the program. ASA model preparation, mesh refinement, runs, and documentation for far-field modeling is expected to cost about $60,000, with a cost per run of approximately $3,500. An additional field data collection program will not be required for either model, although some more data will be required for CSO studies (see Section 2). Selection between the two models must await final word on the availability of the ASA model.

Note that sedimentation problems described below may force the use of a far-field model even if the "Gold Book" water quality requirements are met at the ZID.

iv) Outfall Site Sedimentation Problems

Sedimentation at and around the ZID is a problem which has recently gained much attention in the course of the MWRA Boston Harbor project. Concern centers around the loading of benthic communities by secondary effluent particles which are released by the outfall and which settle to the bottom. These particles may have attached toxic constituents which may "rain" on the organisms at unacceptably high rates. This concern has also been expressed during the current New Bedford outfall siting exercise, and will be addressed using a methodology similar to that proposed for the MWRA project.

The proposed procedure is a two-stage evaluation of the sedimentation potential of the outfall site. The first stage is a conservative, worst-case estimate of sedimentation in the vicinity of the outfall. If the results of the conservative estimates indicate potential damage to the benthic communities because of the sedimentation rates calculated at this stage, a more refined analysis (incorporating far-field dispersion and modeling in addition to sedimentation/coagulation) will be made.

This is a ground-breaking procedure which, to CDM's knowledge, has not been tested in any application involving ocean outfalls. It is being proposed in both the MWRA and New Bedford projects in lieu of depending entirely on generalized sediment maps, core samples and sketchy knowledge of the Bay-wide circulation system to draw the appropriate conclusions. Interpretation of the numerical analysis, however, will be aided by such maps and circulation studies published previously by various investigators. The following is a synopsis of the proposed methodology:

- A "first-cut" estimate of the sedimentation rate at the diffuser will be made by utilizing conservative assumptions; e.g., that all particles will settle within the tidal excursion zone (tidal ellipse), no sediment resuspension, constant settling velocities, no eddy diffusivities hampering settling of finer particles, etc. The sedimentation rate will be converted to rates of addition of toxic constituents to the ocean bottom, and the impact on organisms will be inferred from these data. This analysis will use data from current meter records at sites of interest, as well as information on the expected characteristics of the secondary effluent. A refinement of the "first-cut" settling analysis will be made by incorporating the results of ongoing MWRA studies on the effect of particle agglomeration (coagulation) and eddy diffusivity on the settling process. If the resulting sediment (and hence toxics) loading rates are determined not to be critical in this conservative case, the site is deemed to be adequate from the sedimentation viewpoint, and no further analysis will be necessary.

- o The second stage of the study will come into effect only if the conservative analysis of the first stage indicates that a potential problem exists with the sedimentation rates derived earlier. At the second stage, sedimentation routines will be incorporated in a far-field model to determine settling rates at and around the diffuser when more realistic dispersion and advection mechanisms are considered. If the resulting loading rates still exceed critical levels, the site may be considered for rejection as a potential outfall siting area.

  Note that the determination of whether a sedimentation rate is acceptable to the local benthic communities must be performed by a qualified marine biologist familiar with the dynamics of local ecosystems. Such a study will be considered as being part of the sedimentation evaluation process.

(v) Outfall Site Nutrient Enrichment Problems

A major issue raised in connection with the siting of the ocean outfall is the question of increased incidence of phytoplankton blooms caused by potential enrichment of the outfall vicinity through addition of refined ammonium compounds contained in the effluent. Concern has been raised in the MWRA project about the effects of adding a hitherto limiting nutrient into the processes which produce phytoplankton blooms. Once again, very little is known of the processes and existing baseline conditions at this point to enable predictions to be made in the New Bedford project area.

Conversations with Dr. Brian Howes of Woods Hole indicate that no full- scale studies addressing the question have been performed in Buzzard's Bay near the project site. He was not aware of any serious phytoplankton bloom problems in Buzzards Bay. The exception is the occasional blue-green algae blooms which have occurred sporadically throughout Buzzard's Bay. These blooms are believed by Woods Hole to be naturally occurring phenomena.

The only Buzzard's Bay nutrient enrichment field project WHOI has been involved in at this time has been a study for the community of Orleans in the Cape Cod area. The community was concerned over the possible effects of a nutrient-rich migrating groundwater plume (originating from septic tank leachate) on the water quality of the local receiving waters. The study was performed in a closed cove, which was already in an advanced stage of nutrient enrichment, as opposed to the open ocean which would be more representative of the conditions in the New Bedford area. The methodologies employed, however, would be similar, should a study be carried out for New Bedford.

MWRA is currently conducting a nutrient field survey of the type proposed in CDM's June 11 letter. The MWRA program is a 3-month program conducted during the summer months of baseline primary productivity in the vicinity of the proposed outfall sites. The study, conducted jointly by researchers from University of New Hampshire and University of Rhode Island, is expected to cost approximately $100,000. It includes laboratory-scale testing of the response of the local microflora to addition of simulated sewage effluent. One disadvantage of this study is the fact that time constraints permit only summer season sampling, ignoring spring and fall bloom seasons.

Subsequent conversations with Dr. Brian Howes of WHOI indicate that if funds can be committed immediately, WHOI can mobilize to commence regular field sampling and laboratory analyses in August. A spot sampling of selected parameters could be performed on an emergency basis sometime in July. The approximate price tag of a August 87 - August 88 study will be about $250,000. The paper study proposed in CDM's June 11 letter will be incorporated into the nutrient study.

The paper study may be especially significant in that it may shed some light on the mechanisms and kinetics which govern the process of nutrient enrichment by sewage effluent and the dynamic response of the phytoplankton community. This will help to provide a better focus for future outfall siting nutrient studies, and will enable modeling efforts to be initiated in this new field.

2. COMBINED SEWER OVERFLOWS

As mentioned in the section on far-field modeling, the program developed by ASA (a 2-D, vertically averaged finite element model) has recently come to the attention of CDM. This model was developed on behalf of the defendants of the ongoing litigation over New Bedford Harbor pollution, and its availability is currently under negotiation. It is likely, however, that the model will become available for use in the New Bedford CSO modeling tasks.

CDM understands that this model covers the area between the 301(h) waiver outfall site and the Acushnet Estuary, and incorporates Clark's Cove as well. The model was calibrated to all known oceanographic data in New Bedford Harbor, including Dr. Geyer's 1986 field work. As ASA has modeled Buzzard's Bay and Rhode Island Sound in the past, extension of the model boundaries past the 301(h) site is claimed to be possible. The development of this model was accompanied by a massive dye study in the Harbor, when the dye was released and monitored over a period of 6 days in November 1986. Particle settling may also be simulated based on the results of the flow fields generated by this model.

CDM believes that a depth-averaged model may not adequately simulate the vertical distribution of wind- and density-driven components of circulation within the harbor, especially in the Acushnet Estuary area. However, the circulation of other areas of the harbor (Inner Harbor, Outer Harbor, and Clark's Cove) are dominated by tidal flows, and are probably adequately described by the model.

Assuming that the model in one form or other will become available for use on the project, CDM proposes the following:

- o Commission field studies as proposed by Dr. Geyer of WHOI to define the wind- and density-driven circulation components in New Bedford Harbor. This field study may incorporate additional studies in the Harbor in support of the ASA modeling effort.

- o Use the ASA model (or a similar model) for evaluation of various CSO discharge alternatives as part of the CSO Facilities Plan. The results of the simulations will be evaluated in conjunction with the above field study results in those areas where wind- and density-driven circulation are significant. The ASA model may offer major cost savings (50% - 60%) over the much more complex Battelle model, and yet may provide accurate results when the output is interpreted in conjunction with the field study data. For an evaluation of ten (for example) CSO discharge scenarios, the modeling/documentation costs will amount to approximately $65,000. Incremental cost per run is approximately $2,500. The ASA model may have to be modified to accept multiple CSO inputs.

3. SUMMARY

Based on a review of the available information\ and conversations with scientists at Woods Hole Oceanographic Institute (WHOI), CDM proposes the following course of action for the impact assessment on New Bedford receiving waters:

OUTFALL SITING

- o Determine whether the EPA "Gold Book" water quality criteria can be met at the Zone of Initial Dilution (ZID) of the proposed secondary treatment plant outfall site(s). ULINE and UDKHDEN will be used in this evaluation. If the criteria can be met at the ZID (near field), it will be assumed that the criteria will be met everywhere else (far field) in the receiving waters.

- o If the "Gold Book" criteria cannot be met, far-field hydrodynamic modeling will be performed using either Battelle's New Bedford Model or the ASA model (subject to availability) for some design conditions. This study will define the perimeter around the outfall at which the EPA criteria can be met.

- o In addition to checks for compliance with EPA water quality criteria, each possible outfall site will be evaluated in light of possible sedimentation problems. The MWRA approach, comprising hand calculations based on conservative assumptions and existing current meter data, will be adopted for use in New Bedford. If this approach indicates potential problems, far-field modeling will be performed to obtain more refined estimates for final evaluation of the adequacy of the proposed site.

- Commission a field baseline study of nutrient conditions at proposed outfall sites (and control points) in New Bedford Harbor/Buzzard's Bay. The study will include a paper study to compile existing information on the subject in Buzzard's Bay as well as elsewhere. If funds can be committed on time, WHOI will mobilize to commence regular samplings in August, with a possible emergency sampling (scaled-down) in July. The study will also include a laboratory test to observe phytoplankton response to the addition of simulated secondary effluent to their habitat.

CSO's

- CDM will commission some field studies in the New Bedford Harbor to determine the effects of wind and density in the circulation within the Harbor. These studies may include drifters, drogues, and dye studies to supplement those performed in late 1986 by Dr. Geyer of WHOI and Dr. Spalding of University of Rhode Island. These studies will also aid in the modeling of the plume hydraulics.

- The various CSO discharge alternatives will be evaluated by use of a far-field model such as that developed by ASA for New Bedford Harbor litigation or by Battelle for the Superfund cleanup. Model selection will take place as soon as detailed information on the ASA model and its availability becomes known. In either case, the output of these models will be evaluated in conjunction with data to be collected in the field (above), especially in the areas where density- and wind-driven circulation may be significant.

4. SUMMER FIELD STUDIES

In implementing the receiving water impact studies outlined above, CDM proposes to commence field studies during the summer of 1987. These studies will continue into the autumn in the case of the CSO/Outfall modeling effort, and into spring/summer of 1988 for the nutrient studies.

CSO/Outfall Modeling

Detailed circulation studies involving dyes, drifters, and current meter data collection and analysis for CSO analysis will be performed under the direction of Dr. Rocky Geyer of WHOI. His efforts will be structured with an eye to satisfying any hitherto unanticipated data collection requirements which may crop up in the course of developing a far-field receiving water model for outfall siting (should it become necessary).

Cost Estimate: $35,000 - $55,000 for CSO data collection, extra for any unanticipated far-field model data collection.

Nutrient Analysis

Field and laboratory work will formally commence in August should funds be committed in time. A possible emergency sampling in July is included in this program. Concurrent with the sampling programs will be a literature search which will compile any existing information on this subject and attempt to focus future research/development of possible modeling methodologies.

Cost Estimate: $200,000 - $300,000 for 12-month nutrient sampling and analysis program. Costs for shorter sampling periods will be proportionately less. Starting date contingent upon commitment of funds.

We hope that this re-submission will be acceptable. We look forward to hearing your thoughts and comments at your earliest convenience so that the first phase of the studies proposed above can commence at the earliest possible date.

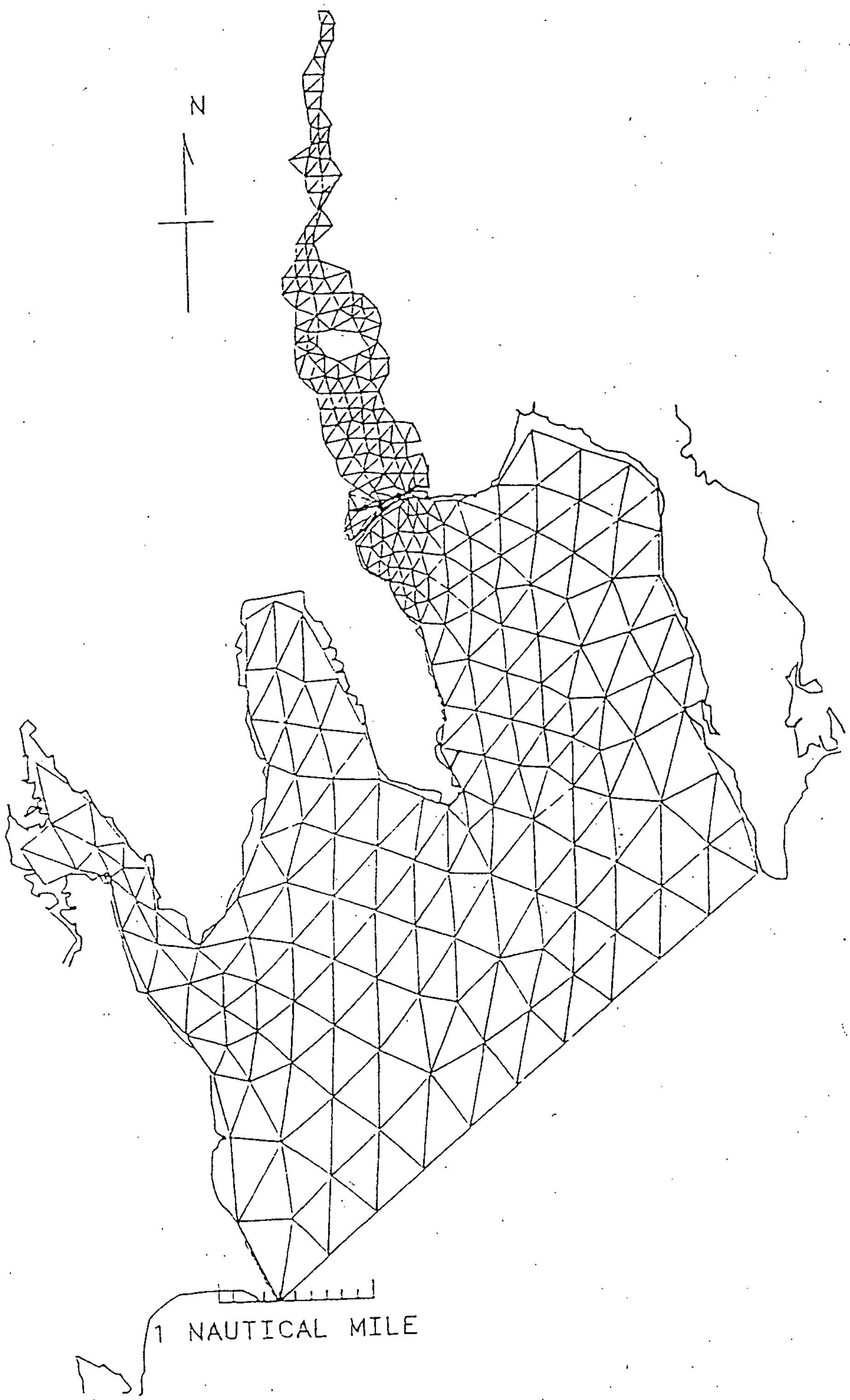
Very truly yours,

CAMP DRESSER & McKEE INC.

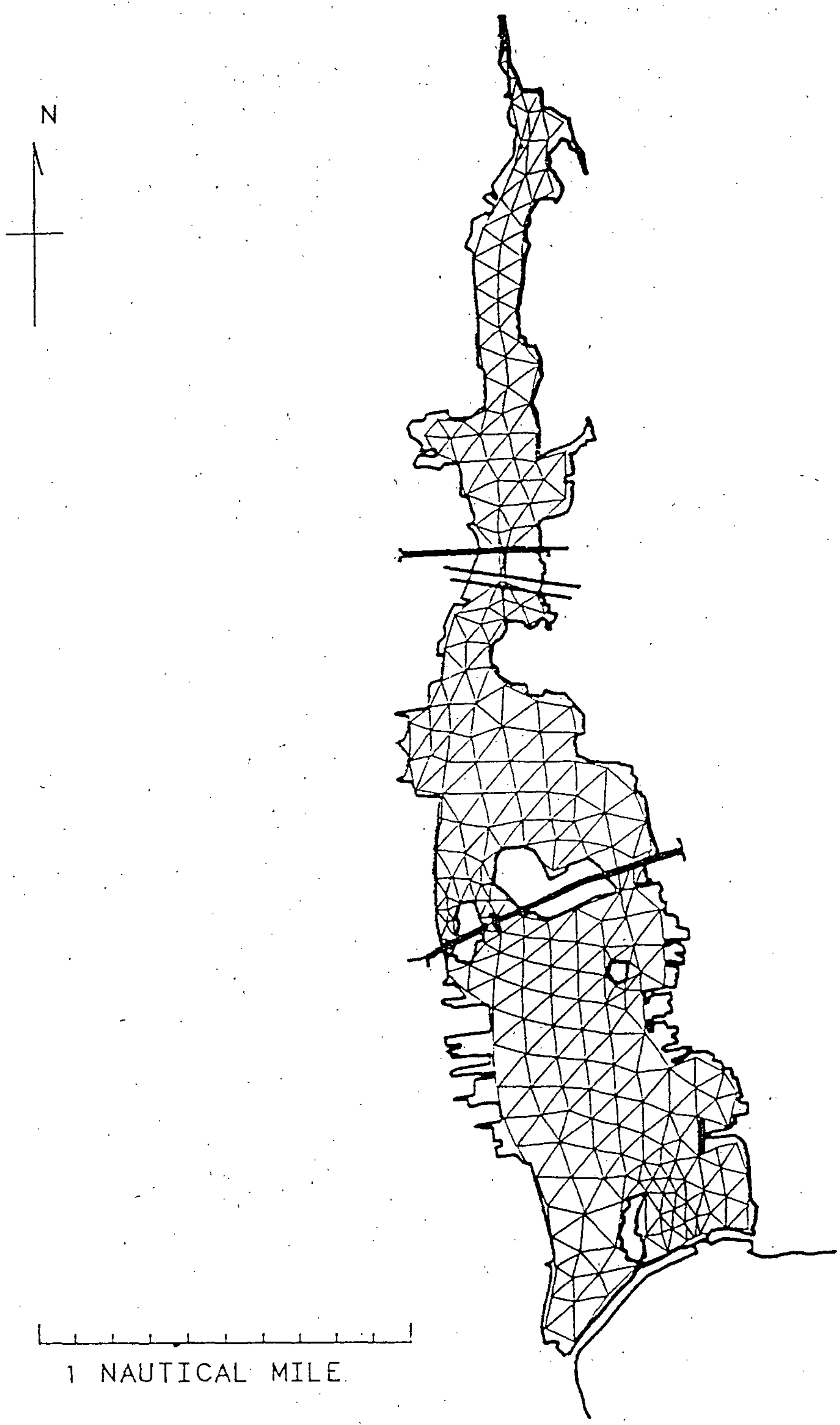
Stephen J. Hickox
Vice President

cc: Mr. Ben Baker
Ms. Marcy Wetherbee

File: 309-124-RT-GEAD



Triangular finite element grid system for outer and inner New Bedford Harbor.



Model triangular finite element grid system.

6/23/97
AM

New Bedford Mtg re: need for an EIS

ADP	WMD	Walter Newman	WQB	Jeff Fowley	ORC
GWH		Gwen Ruta		Edie Goldman	
Dave Luciano		Ron Manfredonia		John Calanen	

Walter: Scope of MEPA review, etc
1) w/ Narragansett lab, working on modeling approach
2) Site screening - CDM has suggested methodology; EPA and state working with them, revised methodology submitted. Sludge disposal footprint not included in proposed methodology (although included in original scope)

5/5/87
New Bedford

Hickox

Plant finally operating @ full sludge capacity; have finally sucked out all solids in the plant

Moving sludge 24 hrs/day; calling in data this PM, should have analysis done

CSO – doing land-based work now (Phase I done – Phase II underway)

Steve Hickox } CDM
Jane Wheeler }

Ron Lyberger }
Alan Slater } DEQE
Larry Gill }

GWH }
Walter Newman } EPA

Siting

Wheeler

- City to provide CDM w/zoning, current use info for initial candidate sites
- Screening process to be used to narrow down list to those to be considered in Phase II Fac Plan

25 acre site

Lyberger questioned why 25

Hickox – Min 70 MGD POTW, probably 90-100 MGD peak; plant of that magnitude needs 25A

Note: for consolidated secondary plant – would be smaller for split plant.

Lyberger – would like min. size for add-on secondary

Newman – size criteria for initial screening should be discussed.

Lyberger
– absence of special conditions not necessarily ~~a~~ to be used to preclude sites. Specifically, ocean sanctuaries act shouldn't preclude consideration of a site.

– site availability should be considered re: degree of difficulty, rather than an absolute

– Ron concluded that first ~~a~~ screen should be based on size alone (min. for 2° add-on)

Hazardous waste issue: presence of hazardous waste shouldn't preclude consideration, if city could clean it up and use it.

Preliminary Outfall siting

Howard Y. (?) (CDM)

– used simplified model to evaluate impact of outfall @ various locations; tracked where particles would go due to tidal flows, estimate of how toxics would be diluted.

Ron wants to concentrate on whether existing outfall is acceptable – if 2° w/ diffuser @ existing site OK, may not need to go further.

City of New Bedford
Secondary Treatment Facilities Plan
Screening Study Phase

SCREENING METHODOLOGY

Background: The existing combined collection and interceptor system can contribute and transport about 70 mgd of wet weather flows to the existing primary plant. The system's control facilities - regulators and pumping stations - as well as the interceptors, have limited hydraulic capacities. System regulator devices and pumping stations divert only a small, incremental amount of storm flow to the interceptor; excess combined sewage is discharged to receiving waters. When the interceptors reach their design flow, hydraulic relief is provided through either side overflow weirs or system surcharging and subsequent discharging at the regulators. For example, a 1 year storm event would result in the same flow rates at the existing plant as a 10 year rainfall event: the excess flows (CSOs) discharge to the receiving waters.

General Methodology: One of the prime objectives when evaluating future treatment needs for the City, is to ensure that existing facilities are used to the maximum extent posssible. For this reason, screening methodology will be based on the concept of the new secondary plant treating, at a minimum, the maximum flows realized in the existing interceptor system. Flows in excess of the existing collection and interceptor systems' capacities - combined sewer overflows - will be either (1) treated at the existing CSO outfalls, or (2) transported and treated at the new secondary plant. Under the second option, alternatives include (a) during a rainfall event (i.e., real-time basis) transporting and treating CSO flows at the plant, (b) during an event transport the flows to the plant for storage and subsequent treatment when capacity becomes available, and (c) collecting and storing the flows at the CSO outfalls during an overflow event, and pumping the stored volume to the plant when capacity becomes available.

Example No. 1 - 100 mgd Secondary Plant at Hurricane Barrier Site

Presented below is a brief example of the proposed methodology that will be used to estimate the cost effectiveness of treating CSOs at a new secondary plant, as compared to treatment at the CSO outlet. The example is based on a secondary plant being located at the Hurricane Barrier site, and the major CSO to be intercepted/treated is No. 004 (96"x84" outlet into Clarks Cove at the Barrier Pumping Station). Reference is made to Fig. 1, which shows the location of the existing

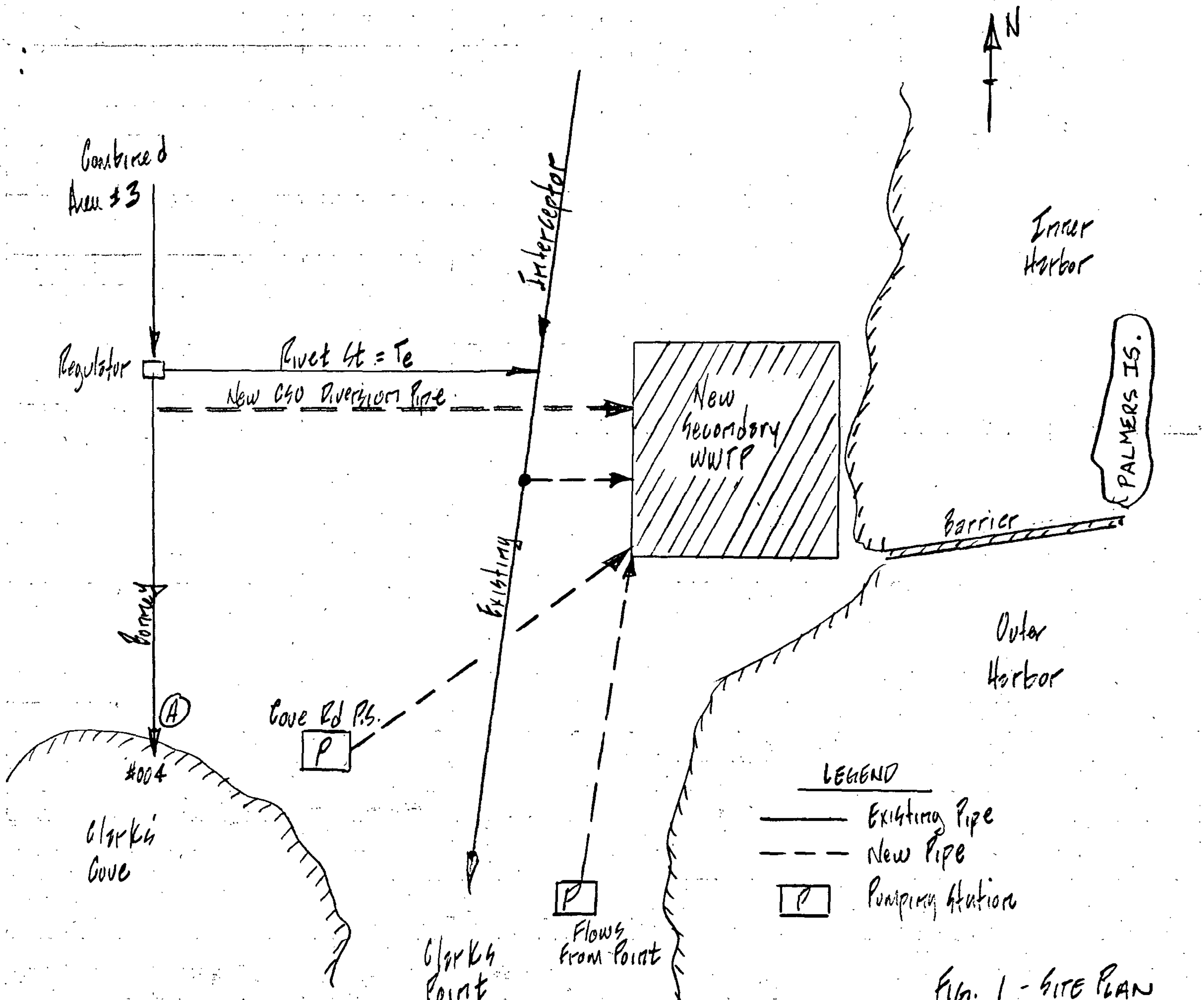
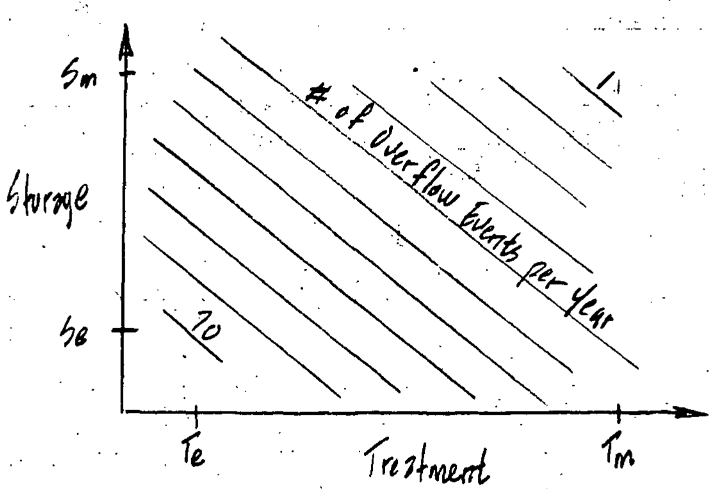
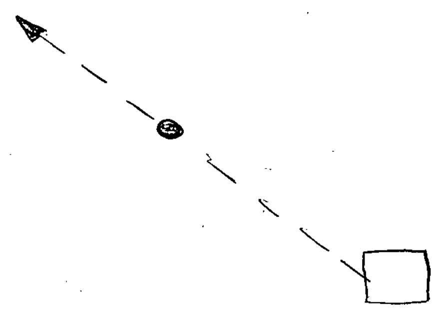


FIG. 1 - SITE PLAN
NTS



Legend -
Te = Existing treatment rate
Tm = Maximum treatment rate
Se = Existing storage volume
Sm = Maximum storage volume

FIG. 2 - S/T CURVE



and proposed facilities. This overflow outlet was selected because it is the prime polluter of Clarks Cove, and its tributary area consists of about one-third of the combined sewered area of the city. Also, because of its location, it would be the most cost-effective overflow to capture and treat at a new secondary plant located at the Hurricane Barrier.

For the sake of this example, it is assumed that the Barrier site can only support a 100 mgd secondary plant. This was determined from preliminary "foot-prints" of various size plants superimposed onto aerial photos of the site. The first step is to determine the available excess capacity at the new secondary plant that could be used for the treatment of CSOs:

a. Assume dry weather wastewater flow projections (year 2015) are-

Average Day	30 mgd
Maximum Day	60 mgd
Peak Flow	100 mgd

b. Plant hydraulic capacity = 100 mgd

c. Existing collection and interceptor systems' capacity = 70 mgd

d. With interceptor improvements, system capacity = 100 mgd (same as plant design)

d. Secondary plant's wet weather capacity available = Design flow - Max Day = 40 mgd

Based on the above, the new plant has an instantaneous flow rate available of 40 mgd. Thus, if 40 mgd of CSOs from Outlet 004 are treated either at the outlet or at the new secondary plant on a real-time basis(during the rainfall event), what is the expected reduction in the number of overflows per year?

actually 50

a. Outlet 004 currently overflows about 70 times per year. A storage/treatment (S/T) curve similar to the one shown on Fig. 2 will be developed for the existing situation: T_e = existing treatment rate out of the area, which is the capacity of the Rivet St. pipe and its connection to the interceptor system; and S_e = existing storage capacity within the system.

b. For the new treatment rate (T_e + 40 mgd) and S_e, from Fig.2 estimate the revised number of overflow days/year.

Knowing the above, different options relating to the cost associated with the treatment of CSOs can now be evaluated.

Option 1 -Treat CSOs at Existing Outfall: Real-time Basis

a. The feasibility (including land availability) of constructing a primary plant (Point A on Fig.1)to capture the overflows from Outlet 004 will be evaluated. Phase 3 CSO studies and the EPA/DEQE policy on CSO discharges will dictate the final treatment process; however for the sake of this analysis, primary treatment will be assumed.

b. Prepare a summary of the estimated costs, including piping, treatment, solids handling, and annual operation and maintenance costs.

c. Summarize Option 1 by presenting the total present worth cost required to treat 40 mgd at the outfall site, and the resulting number of CSO events per year that would still be discharging at this location.

Option 2- Treatment of CSOs at the New Secondary Treatment Plant: Reat-time Basis

a. Size a new diversion pipe which would intercept CSOs at the Bonney /Rivet Street regulator and transport flow to the new secondary plant.

b. Estimate the total present worth cost of the option, including capital and annual operation and maintenance costs

Option 3- With Storage, Treat CSOs at the New Secondary Plant Under this option, storage would be provided to collect and hold the CSO's during the rainfall event, for subsequent treatment at the plant when capacity becomes available. Storage could be constructed either at the plant or at a remote location near the CSO outfall.

a.Storage would be sized based on two factors:1. land availability; and 2. antecedent pumpback rate to the plant (based on interval of rainfall events and available treatment rate at the plant). Once the storage volume is approximated, the resulting reduction in the number of overflow events per year can be estimated using the S/T curve illustrated on Fig. 2.

B. Estimate the cost of constructing and operating the storage facility and appurantances (piping, pumps, solids removal, etc.).

<u>Option 4- With Storage, Treat CSOs at a CSO Treatment Plant at the Outfall</u> This option is the same as Option 3, except that treatment would be at a new CSO treatment facility located near the outfall.

Summarize Results

Summarize and plot the results, as shown on Fig. 3

COMPARISON OF COST vs. OVERFLOWS PER YEAR
@ CSO OUTLET 004 - TREATMENT @ SECONDARY
PLANT OR AT CSO OUTLET

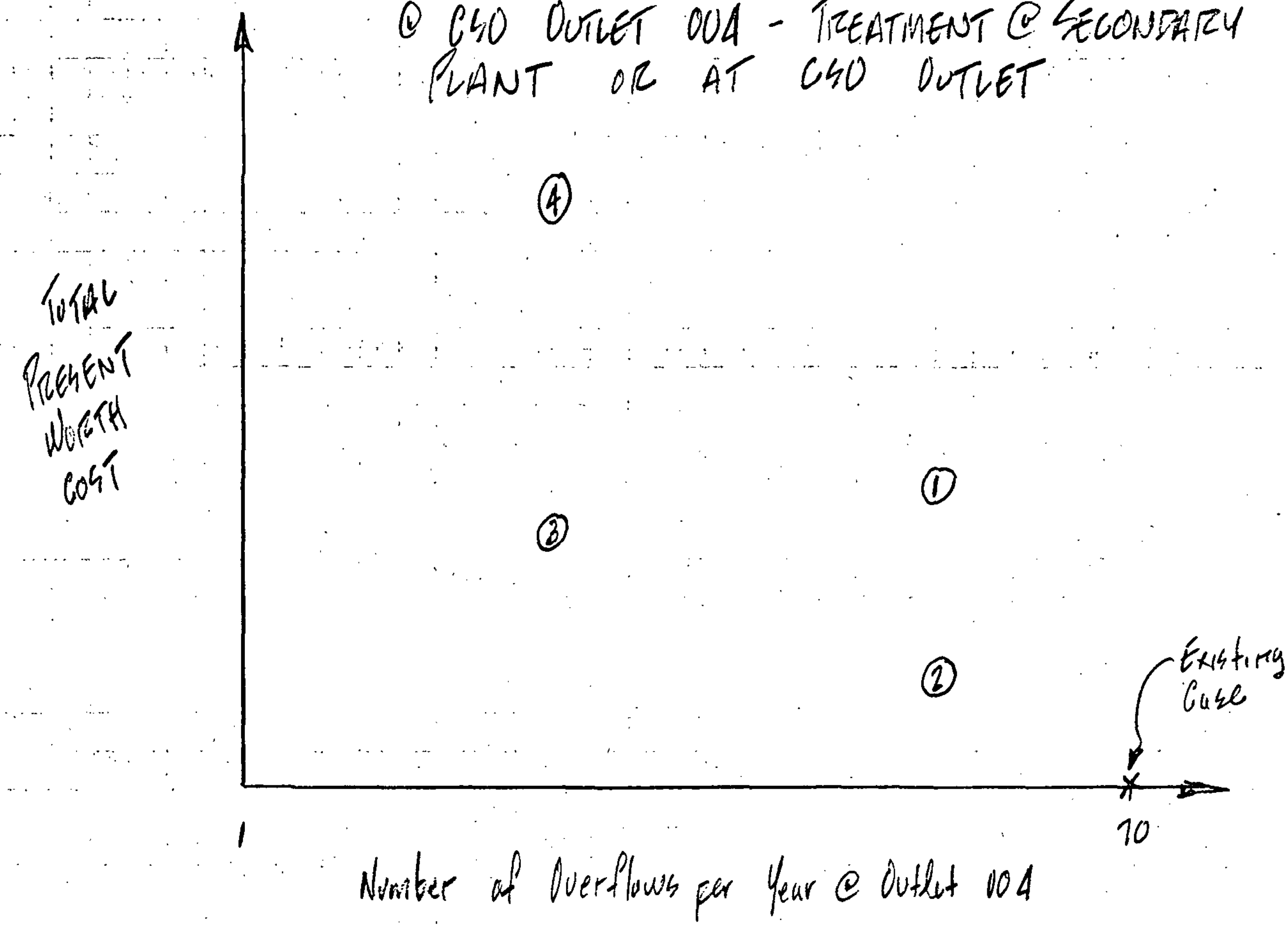


Fig. 3

City of New Bedford

SCREENING STUDY

TECHNICAL MEETING - MAY 5, 1987

1:30 PM at CDM - Fifth Floor

AGENDA

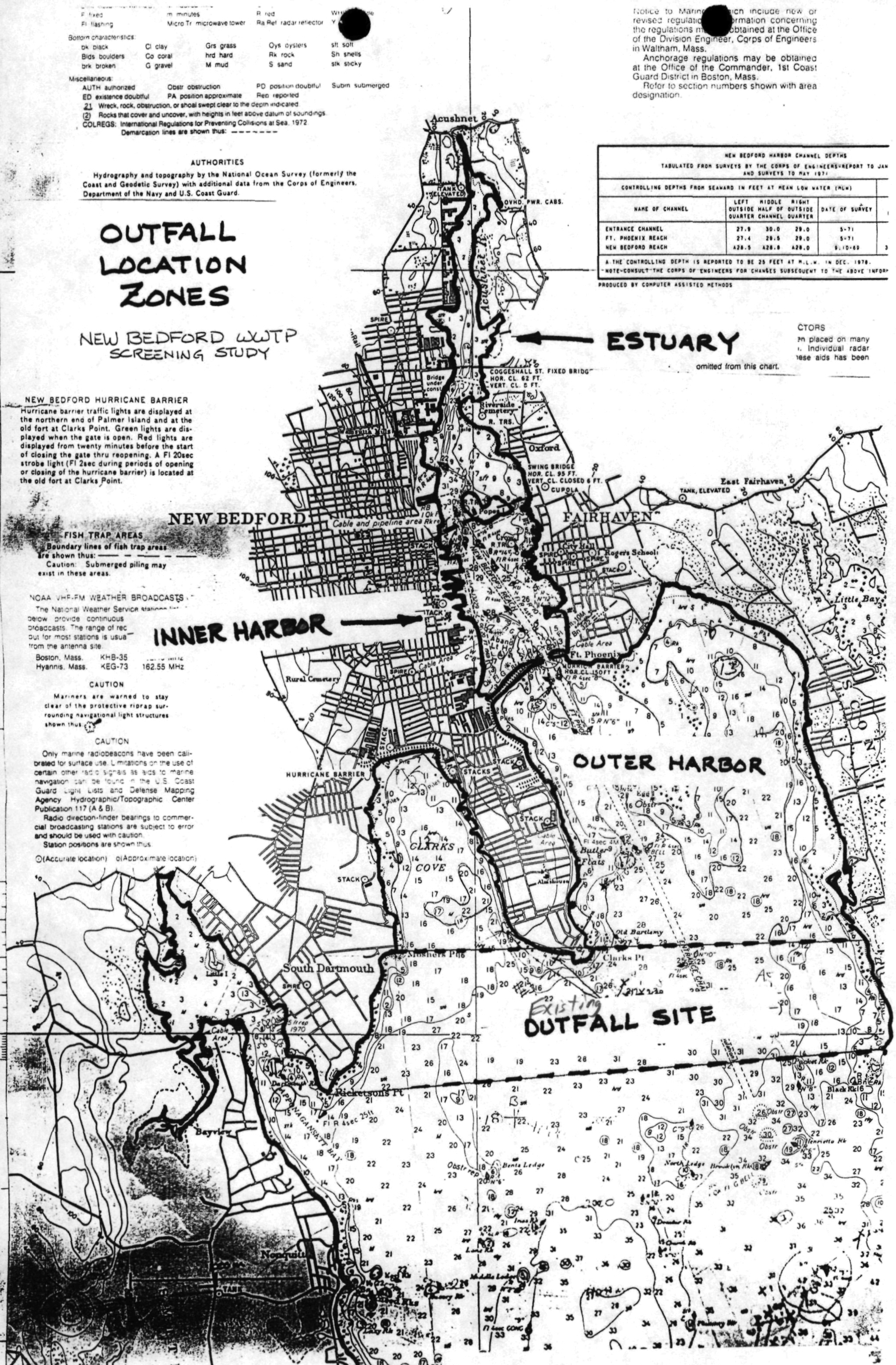
1. Scheduling and progress to date

2. Discussion on plant siting methodology

3. Preliminary siting of outfall

4. Screening methodology - CSO treatment at secondary plant

5. Future meetings



CDM CAMP DRESSER & McKEE INC.
One Center Plaza
Boston, Massachusetts 02108

SITING OF SECONDARY TREATMENT PLANT FOR CITY OF NEW BEDFORD

1. Objectives

The objective of this task is to investigate alternative sites for the secondary wastewater treatment plant and solids management facilities. Ultimate solids disposal sites are not included in this task. The siting activities will document the screening process used to define the site options and preferred site(s).

Key to the attainment of the overall program objective of successful siting of secondary treatment facilities is that the siting process withstand public scrutiny and regulatory agency review for acceptability. Agency concurrence and agreement with the siting process may only be accomplished within the context of appropriate policy guidance and/or regulatory enforcement.

At the state level, the Executive Office of Environmental Affairs (EOEA), through the MEPA Unit, will determine the acceptability of the siting process and criteria through the MEPA Process and specifically through its review of the draft and final Environmental Impact Reports for the Project. Equally important, the siting process must also withstand the scrutiny of the U.S. Environmental Protection Agency as part of that agency's separate and distinct environmental review under the provisions of NEPA.

Specifically, EPA has already gone on the record with this project by stating in its letter of March 9, 1987 to Secretary Hoyte;

> "Federal regulations require that all reasonable project alternatives, including the no action alternative, should be rigorously explored and objectively evaluated. Alternatives can be eliminated from detailed study only on the basis of a reasoned elimination process at an appropriate level of detail. See 40 C.F.R. 1502.14. Thus, the EIR should go beyond the four siting alternatives explicitly named in the scope of work for the screening study (Exhibit A, Section 3.0). It should include consideration of all reasonable sites and should adequately document the process which results in the narrowing of potential sites to a smaller group for detailed consideration."

The siting methodology described herein has therefore been developed cognizant of the responsibilities of these respective agencies, and implementation of the siting process will be accomplished only in light of this.

Some issues associated with the siting of the secondary treatment plant are listed below:

- In siting the secondary wastewater treatment plant and co-located solids management facilities it is assumed that primary treatment will occur either at the existing New Bedford wastewter treatment plant or at the site of the secondary units. The recommended option will be part of the siting analysis. Wastewater conveyance from the primary units to the secondary units to the effluent discharge point will be taken under consideration in the siting efforts. Sites for secondary treatment and solids management will be within the City of New Bedford.

- Sites for ultimate solids disposal are not included in this task and will be based on the evaulation of solids treatement alternatives.

2. Overall Methodology

Identify Initial Candidate Sites

As a result of CDM data gathering activities, and discussions with the City of New Bedford, Municipal Public Works Department, Planning Department and other city staff, initial candidate sites will be identified and described.

Determine Alternative Sites

Specific minimum requirements for all sites will be identified based on an assumed "footprint" of the proposed secondary plant and solids management facilities. These requirements could include such items as minimum usable acreage and availability. All requirements will be prerequisites for development. Section 4 of this summary provides a preliminary list of these screening criteria.

Each of the initial candidate sites in each group will be examined in terms of the minimum requirements. Those sites which have the characteristics that meet the prerequisites will be listed as alternative sites.

Determine Preferred Site

Each alternative site will then be assessed in terms of a common set of comprehensive screening criteria. These secondary criteria will include a variety of evaluation factors of potential environmental impact, availability/implementation, and costs. Each site will describe in light of its assets (advantages) and limitations (disadvantages) for the proposed use. The specific criteria to be used include the following:

Environmental and Physical (and Required Mitigation)

- Land Use
- Transportation and Access
- Visual Quality
- Noise
- Odors
- Air Quality
- Marine Environment
- Natural Resources (Ecology, Wetlands, Water quality)
- Historic and Archaeological Resources
- Recreational Opportunities
- Soils and Groundwater
- Drainage

Availability/Implementation

- Minimum Area
- Ownership
- Zoning
- Conformance to Local Plans
- Required Permits
- Required Wastewater Transport

Cost

- Capital and O&M (Plant and Transport)
- Mitigation

As a result of this assessment, a preferred site(s) (and wastewater transport route) will be recommended for location of the secondary treatment plant and co-located sludge management facilities.

3. Preliminary List of Initial Candidate Sites

A preliminary listing of possible initial candidate sites for the location of the secondary treatment facilities has been provided by the New Bedford City Planning Department as shown on Table 1.

This listing represents a compilation of open space property. Locations of the preliminary list of initial candidate sites are indicated on Figure ___.

Because there is no existing comprehensive data base in these sites, baseline information is currently being compiled which includes approximate acreage as compiled from tax maps, ownership status, current use and zoning designation.

TABLE 1

INITIAL CANDIDATE SITES
FOR SECONDARY WASTEWATER TREATMENT FACILITIES

1. Ft. Rodman
2. Hazelwood Park
3. Berskhire-Hathaway Mill Complex
4. Standard-Times Field
5. Rural Cemetery
6. Buttonwood Park
7. Railroad Property
8. Property north of North Terminal
9. Oak Grove Cemetery
10. Property north of Hathaway Rd.
11. Sullivan's Ledge
12. Whaling City Golf Course
13. Property east of Belleville Ave. between Sawyer St. and Coffin Ave.
14. Water Department/Solid Waste
15. Sacred Hearts Cemetery
16. Property behind Chamberlain Mnfg.
17. FTZ/Air Industrial Park
18. NB Municipal Airport
19. Brooklawn Park
20. Property west of Church St., east of Rte. 140
21. Pine Grove Cemetery
22. Great Ceder Swamp
23. Property Located north of Arnoff St.
24. Sassequin Pond
25. Property Located east of Braley Rd., south of the Freatown Line
26. Property north of Sassaquin Pond

Source: New Bedford City Planning Dept. (1987)

4. Preliminary List of Screening Criteria (Specific Minimum Site Requirements)

A preliminary list of screening criteria has been developed which details the specific minimum site requirements to be applied during initial site screening. Essentially, the initial site screening will utilize these criteria to disqualify and eliminate sites from further consideration on the basis of physical characteristics, location, or availability.

The use of specific minimum site requirements can be considered an exclusion process. This initial screening does not select among favorable sites, but only eliminates those sites that cannot be developed in light of the programs basic objectives and obviously restrictive environmental impacts. The favorable and unfavorable aspects of the remaining sites will then be analyzed in greater detail with the application of comprehensive screening criteria in the next screening phase (Phase III).

The first step of the Phase I screening -- identification of initial candidate sites -- was described above. Under this Phase II screening, the following preliminary minimum site criteria have been developed based upon the program objectives and the proposed facility's physical requirements (i.e. the "footprint"):

- o Minimum site size: 25 acres
- o Adequate or compatible site configuration
- o Site ownership and availability
- o Site access
- o The absence of any special conditions which could preclude development
- o Compatibility with existing system hydraulics

These are described in more detail below:

Adequate Site Size

An estimted 25 acres would be required for a secondary plant capable of treating the city's peak flow wastewater rates, excluding combined sewer overflows. This minimum acreage requirement provides for:

- o Servicing the facility by truck transport,
- o A limited buffer area between the facility and adjacent land uses, and
- o Construction staging areas within the site limits.

A representative 25 acre parcel would be made up of an area 1,000 feet by 1,100 feet.

Adequate or Compatible Site Configuration

A 25 acre site must have an approximately square configuration, to a minimum width of about 700 feet. A site much narrower than 700 feet could inhibit inclusion of visual buffers or provisions for vehicular movement and material transfer along the perimeter. The parcel should also be without easement restrictions.

Site Availability

The site must not be committed to other uses, particularly those involving legal restrictions, such as parklands. Some sites which were vacant or underutilized when first considered for wastewater facility planning may have since undergone a change in status.

Site Access

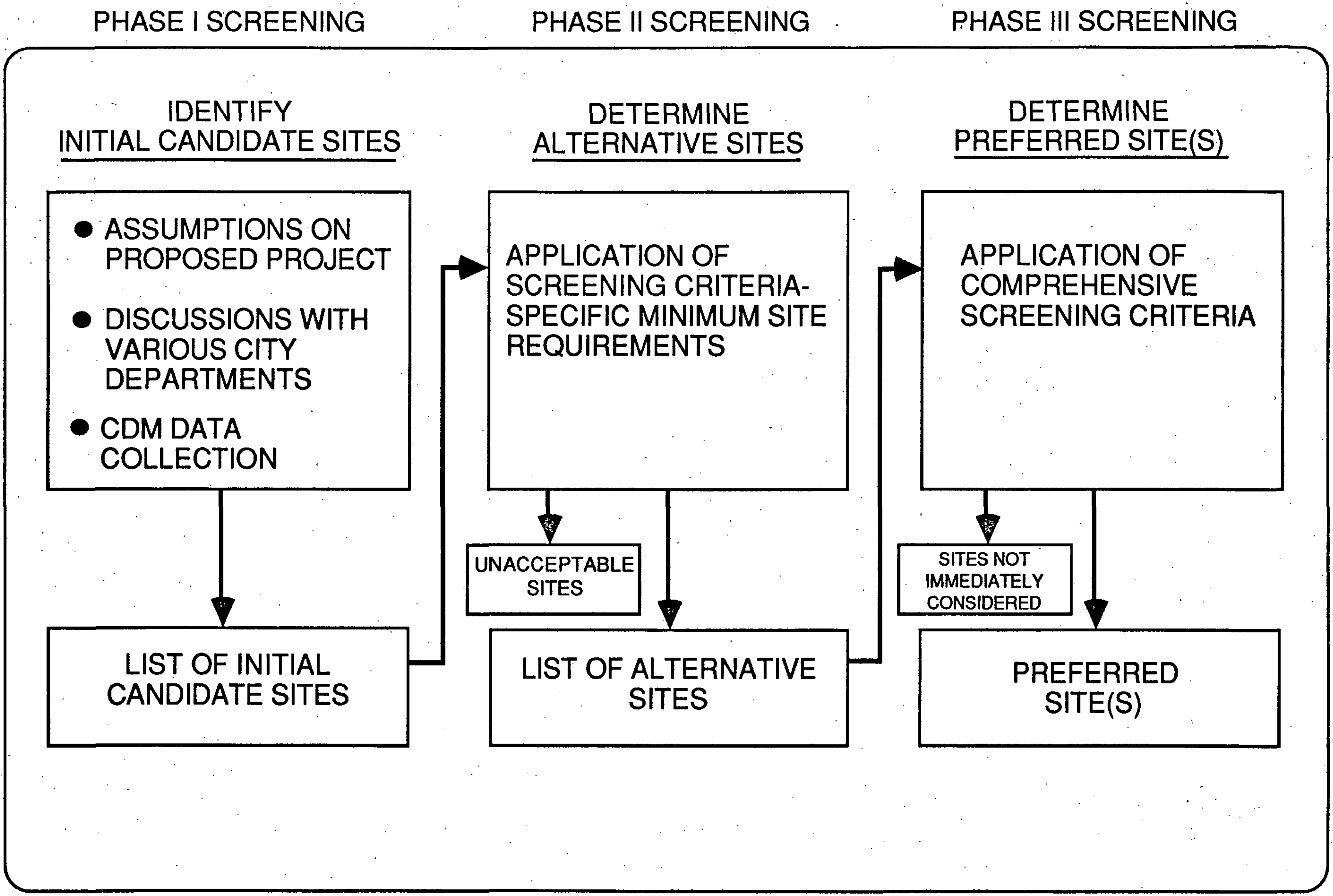
Site of minimum size must have adequate road access that could handle truck traffic and heavy construction equipment.

Absence of Special Conditions Precluding Development

Examples of readily identifiable conditions which could preclude considering a site for development include building height restrictions, the presence of unique historic resources, endangered species, or in compatibility with adjacent land use.

Compatibility with Existing System Hydraulics

The existing system flows southerly to Clarks Point and the existing WWTP. Selection of a site north of the Brooklawn Park area would result in excessive costs/technical infeasibility associated with the pumping and transport of a large percentage of the city's flows hydraulically upgradient to a new site.



CITY OF NEW BEDFORD - SECONDARY TREATMENT PLANT
SCREENING METHODOLOGY FLOWCHART

Jim Small (CDM)

- check w/ Dave G. re: availability of Battelle data to CDM. Lyberger concerned that we decide on whether add'l sampling, testing necessary.

CSO Screening methodology

- looking a C/E of treating CSO's @ POTW.

For 001

- currently 50/year
- if 200 MGD treatment provided (w/o storage), only 4 discharges/year
- would need 40 MG to reduce # discharges to 1/year (20 MG for 4 discharges/year)

M E M O R A N D U M

TO: Files

FROM: Jonathan F./Howard Y.

SUBJECT: New Bedford Screening Study (Receiving Waters)
Summary of Work to Date

DATE: 29 April 1987

1. OBJECTIVE

Approximate receiving waters analyses have been performed during this Screening Study of the New Bedford WWTP Facilities Plan in order to identify the most promising potential outfall sites. These sites would then be considered in detail during the Facilities Plan stage, when computer simulations will be performed to determine the impacts of placing an outfall at these sites.

The four outfall zones are: Acushnet Estuary, Inner Harbor, Outer Harbor, and Existing Outfall. The Acushnet Estuary zone extends from the mouth of the Acushnet River to Pope's Island. The Inner Harbor zone is bound by Pope's Island to the north and the Hurricane Barrier to the south.

The Outer Harbor is that part of Buzzards Bay between the downstream side of the Hurricane Barrier and a straight line extending due east from Clark's Point and intersecting with the Sconticut Neck. The Existing Outfall zone is bound to the north by the Clark's Point/Sconticut Neck line and to the south by an approximate east-west line drawn from the tip of Sconticut Neck (Wilbur Point) to South Dartmouth (Ricketsons Point).

2. DATA COLLECTION

Battelle Duxbury has made available to CDM the field data and studies collected to date for the development of the EPA New Bedford Harbor simulation model. Also available are field data collected to date by CDM and other investigators in the course of 301(h) Waiver Applications by the City of New Bedford (1979, 1983).

Special studies commissioned by Battelle Duxbury of particular interest to the current and later stages of the WWTP Facilities Plan include:

- o Drifter studies in Outer Harbor and Outfall zones

- o Inner Harbor Circulation/Dispersion Study Currently awaiting funding and scheduled to proceed in a couple of months is a intensive follow-up study on Inner Harbor circulation and dispersion patterns. This study, proposed by Battelle to EPA, will provide information needed to calibrate the Inner Harbor/Estuary portions of the Battelle New Bedford model.

3. QUANTITATIVE ANALYSIS AND TENTATIVE RESULTS

The quantitative analysis of the various tidal processes in the receiving waters involved the estimation of ultimate (equilibrium) dilution rates and relative concentrations of various effluent constituents in the tidally affected reaches of the harbor. A simple four-cell tidal model representing the four New Bedford Harbor zones was employed for this purpose. The program was modified to allow constant (WWTP) as well as pulsed (SRO/CSO) pollutant inflow into each of the segments. In the model, the diurnal tidal cycle was the driving force for the one-dimensional, completely-mixed flow of water into and out of the harbor.

Two types of analyses were run using this model on a desktop computer. The first analysis yielded estimates of expected dilutions obtainable in each of the four receiving water zones, given a WWTP outfall in one of the zones. Given these dilutions, "ball-park" estimates of the ultimate concentrations of WWTP effluent constituents can be made at each of the zones for an outfall of a specified location (Table 1).

This information was also used to obtain estimates of dilutions required for toxic wastes (as identified in the New Bedford Industrial Pretreatment Plan) in order to meet the current (1985 EPA "Gold Book") receiving waters criteria. Table 2 lists the Gold Book criteria, and Table 3 lists the required dilution reductions for the case where the effluent outfall is located in the Estuary zone. Requirements are listed for meeting EPA limits in each of the four zones. Tables 4 through 6 were compiled for outfall locations in the Inner Harbor, Outer Harbor, and Diffuser Site respectively.

Another major analysis which may be performed with this desktop method is the evaluation of the relative contributions of the proposed New Bedford WWTP, the CSO's, and the storm run-offs (SRO's) to the total concentration of selected constituents in the New Bedford Harbor zones. CSO's and SRO's were released into the different zones at timed intervals for set durations each time (with and without the WWTP), and the model was allowed to run for several simulated weeks of time to track the fluctuations over time of constituent concentrations in each of the zones. Results of these runs are summarized on Table 7.

Note that the effluent flow rate is an assumed average daily figure. Peak design flows are expected to be in the vicinity of 100 MGD. Analyses using the peak flows will be performed once the flows are finalized.

The CSO and SRO releases were timed using average storm intervals and durations. The New Bedford CSO Phase I Study (1983) determined that 60 to 70 CSO events occur in one year on the average, and that about 80 storm run-off events take place during an average year. Annual TSS, BOD, and coliform loadings for CSO and storm run-off events were also estimated in the study.

Rainfall studies on general precipitation characteristics of the Boston area (Mystic River Basin Study, CDM, 1981) indicated that the average duration of a rainfall event in the area is about six hours. These facts were combined to derive the duration, time interval, flows, and concentrations associated with CSO and storm run-off events. In the New Bedford Harbor desktop analysis, CSO and storm run-off events were timed to occur every five days for six hours duration at each event.

The above analysis assumes that all constituents are well mixed across the cross section of the various receiving water zones. In actuality, however, storm run-off and combined sewer overflows tend to hug the shoreline rather than venture out to the center of the harbor. The "completely mixed" assumption applies more to WWTP outfalls, which will be designed to achieve maximum initial dilutions at the site. Thus the above table represents overall average concentrations rather than spot concentrations measurable at any given location.

Preliminary analyses were performed using the desktop model to determine relative particle settling rates at each zone for outfall locations in any given zone. The results appear to indicate that the least settling occurs in each of the cells when the outfall is placed in the zone with the existing diffuser. These results, however, are tentative, and the final settling tables will be included in the Screening Report.

The information obtained from the quantitative analyses described above will be combined with the various sets of oceanographic and biological data for New Bedford Harbor/Buzzards Bay during the alternatives evaluation phase of the screening study. These will then be used to judge the feasibility of locating WWTP outfalls at various alternative receiving waters zones. The following sections outline other factors which may be considered during the evaluation of various outfall sites.

4. OTHER ISSUES ASSOCIATED WITH SITING OUTFALLS

Several issues will have to be addressed at the time alternative outfall sitings are being discussed. These will be combined with the quantitative results summarized in Section 2 to reach tentative conclusions on outfall siting. Although other considerations will arise in the course of the discussions, we have identified the following issues related to the outfall siting:

- o Possibility of sediment scour and resuspension in Estuary and Inner Harbor zones, where most of the PCB hot spots reside.

- Aesthetics considerations in discharging a 30 MGD jet into waters of limited depth; average depth of Estuary is only 7 feet or so, although the narrow river channel is as deep as 20 feet in places. Will there be an ugly boil?
- How will discharge at any specific location affect the recreational uses of the shoreline? Beaches? Shellfishing? Fishing? ...
- Effect of Hurricane Barrier in transport of sediments, etc.
- Effect of nutrients, particularly ammonium, in the secondary discharge on stimulating phytoplankton blooms.

TABLE 1

New Bedford Harbor Dilution Capacity

OUTFALL LOCATION	Maximum Relative Concentrations at: Estuary	Inner H.	Outer H.	Existing Outfall ~~Diffuser~~
Acushnet Estuary	43	21	6	2
Inner Harbor	17	19	6	2
Outer Harbor	5	5	5	2
Existing Outfall ~~Diffus~~er Site	2	2	2	2

NOTE: Influent Concentration = 1000
Assumed Influent Flow = 30 MGD

Plant effluent

Long term ; far-field analysis; doesn't model zone of initial dilution.

TABLE 2

EPA "Gold Book" Criteria

CONSTITUENT	ACUTE AQ.	CHRONIC AQ.	HUM. TOXIC	HUM 10^6
beta-Endosulphan	0.034	0.0087	159.0	–
Heptachlor	0.053	0.0036	–	0.000285
PCB (Total)	10.0	0.03	–	0.000079
Cadmium	43.0	9.30	–	–
Chromium	1100.0	50.0	–	–
Copper	2.9	–	–	–
Lead	–	–	–	–
Mercury	2.1	0.025	0.146	–
Nickel	140.0	7.1	100.0	–
Selenium	410.0	54.0	–	–
Silver	2.3	–	–	–
Zinc	170.0	58.0	–	–
Cyanide	1.0	–	–	–

TABLE 3

REQUIRED CONSTITUENT CONCENTRATION REDUCTIONS
(Outfall Location: Acushnet Estuary)

CONSTITUENT	CRITERION	ESTUARY	INNER H.	OUTER H.	DIFFUSER
b-Endosulphan	CMC	1.2647	0.6176	0.1765	0.0588
	CCC	4.9425	2.4138	0.6897	0.2299
	Hum. T.	0.0003	0.0001	0.0000	0.0000
Heptachlor	CMC	0.9736	0.4755	0.1358	0.0453
	CCC	14.33	7.00	2.00	0.67
	Hum 10^6	181.05	88.42	25.26	8.42
PCB(Total)	CMC	0.0271	0.0132	0.0038	0.0013
	CCC	9.0300	4.4100	1.2600	0.4200
	Hum 10^6	3429.1	1674.7	478.7	159.5
Cadmium	CMC	0.1200	0.0586	0.0167	0.0056
	CCC	0.5548	0.2710	0.0774	0.0258
Chromium	CMC	0.0049	0.0024	0.0007	0.0002
	CCC	0.1084	0.0529	0.0151	0.0050
Copper	CMC	1.1862	0.5793	0.1655	0.0552
Mercury	CMC	0.0293	0.0143	0.0041	0.0014
	CCC	2.4596	1.2012	0.3432	0.1144
	Hum. T.	0.4212	0.2057	0.0588	0.0196
Nickel	CMC	0.0430	0.0210	0.0060	0.0020
	CCC	0.8479	0.4141	0.1183	0.0394
	Hum. T.	0.0602	0.0294	0.0084	0.0028
Selenium	CMC	0.0059	0.0029	0.0008	0.0003
	CCC	0.0446	0.0218	0.0062	0.0021
Silver	CMC	0.0841	0.0411	0.0117	0.0039
Zinc	CMC	0.0029	0.0014	0.0004	0.0001
	CCC	0.0085	0.0041	0.0012	0.0004
Cyanide	CMC	6.4500	3.1500	0.9000	0.3000

NOTES: CMC = Acute Aquatic Toxicity
CCC = Chronic Aquatic Toxicity
Hum. T. = Acute Toxicity in Humans
Hum 10^6 = Long-term mortality for 1:1,000,000 Humans

*** Dilution Requirements > 1.0 require corrective action ***

TABLE 4

REQUIRED CONSTITUENT CONCENTRATION REDUCTIONS
(Outfall Location: Inner Harbor)

CONSTITUENT	CRITERION	ESTUARY	INNER H.	OUTER H.	DIFFUSER
b-Endosulphan	CCC	0.5000	0.5588	0.1765	0.0588
	CMC	1.9540	2.1839	0.6897	0.2299
Heptachlor	CCC	0.385	0.430	0.136	0.045
	CMC	5.667	6.333	2.000	0.667
	Hum 10^6	71.58	80.00	25.26	8.42
PCB (Total)	CCC	0.0107	0.0120	0.0038	0.0013
	CCC	3.5700	3.9900	1.2600	0.4200
	Hum 10^6	1355.70	1515.19	478.48	159.49
Cadmium	CMC	0.0474	0.0530	0.0167	0.0056
	CCC	0.2194	0.2452	0.0774	0.0258
Chromium	CMC	0.0019	0.0022	0.0007	0.0002
	CCC	0.0428	0.0479	0.0151	0.0050
Copper	CMC	0.4690	0.5241	0.1655	0.0552
Mercury	CMC	0.0116	0.0129	0.0041	0.0014
	CCC	0.9724	1.0868	0.3432	0.1144
	Hum. T.	0.1665	0.1861	0.0588	0.0196
Nickel	CMC	0.0170	0.0190	0.0060	0.0020
	CCC	0.3352	0.3746	0.1183	0.0394
	Hum. T.	0.0238	0.0266	0.0084	0.0028
Selenium	CMC	0.0023	0.0026	0.0008	0.0003
	CCC	0.0176	0.0197	0.0062	0.0021
Silver	CMC	0.0333	0.0372	0.0117	0.0039
Zinc	CMC	0.0011	0.0013	0.0004	0.0001
	CCC	0.0033	0.0037	0.0012	0.0004
Cyanide	CMC	2.5500	2.8500	0.9000	0.3000

NOTES: CMC = Acute Aquatic Toxicity
CCC = Chronic Aquatic Toxicity
Hum. T. = Acute Toxicity in Humans
Hum 10^6 = Long-term mortality for 1:1,000,000 Humans

*** Dilution Requirements > 1.0 require corrective action ***

TABLE 5

REQUIRED CONSTITUENT CONCENTRATION REDUCTIONS
(Outfall Location: Outer Harbor)

CONSTITUENT	CRITERION	ESTUARY	INNER H.	OUTER H.	DIFFUSER
b-Endosulphan	CMC	0.14706	0.14706	0.14706	0.05882
	CCC	0.57471	0.57471	0.57471	0.22989
	Hum. T.	0.00003	0.00003	0.00003	0.00001
Heptachlor	CMC	0.113	0.113	0.113	0.045
	CCC	1.667	1.667	1.667	0.667
	Hum 10^6	21.05	21.05	21.05	8.42
PCB (Total)	CMC	0.0032	0.0032	0.0032	0.0013
	CCC	1.0500	1.0500	1.0500	0.4200
	Hum 10^6	398.73	398.73	398.73	159.49
Cadmium	CMC	0.0140	0.0140	0.0140	0.0056
	CCC	0.0645	0.0645	0.0645	0.0258
Chromium	CMC	0.0006	0.0006	0.0006	0.0002
	CCC	0.0126	0.0126	0.0126	0.0050
Copper	CMC	0.1379	0.1379	0.1379	0.0552
Mercury	CMC	0.0034	0.0034	0.0034	0.0014
	CCC	0.2860	0.2860	0.2860	0.1144
	Hum. T.	0.0490	0.0490	0.0490	0.0196
Nickel	CMC	0.0050	0.0050	0.0050	0.0020
	CCC	0.0986	0.0986	0.0986	0.0394
	Hum. T.	0.0070	0.0070	0.0070	0.0028
Selenium	CMC	0.0007	0.0007	0.0007	0.0003
	CCC	0.0052	0.0052	0.0052	0.0021
Silver	CMC	0.0098	0.0098	0.0098	0.0039
Zinc	CMC	0.0003	0.0003	0.0003	0.0001
	CCC	0.0010	0.0010	0.0010	0.0004
Cyanide	CMC	0.7500	0.7500	0.7500	0.3000

NOTES: CMC = Acute Aquatic Toxicity
CCC = Chronic Aquatic Toxicity
Hum T. = Acute Toxicity in Humans
Hum 10^6 = Long-term mortality for 1:1,000,000 Humans

*** Dilution Requirements > 1.0 require corrective action ***

TABLE 6

REQUIRED CONSTITUENT CONCENTRATION REDUCTIONS
(Outfall Location: Diffuser Site)

CONSTITUENT	CRITERION	ESTUARY	INNER H.	OUTER H.	DIFFUSER
b-Endosulphan	CMC	0.05882	0.05882	0.05882	0.05882
	CCC	0.22989	0.22989	0.22989	0.22989
	Hum. T.	0.00001	0.00001	0.00001	0.00001
Heptachlor	CMC	0.045	0.045	0.045	0.045
	CCC	0.667	0.667	0.667	0.667
	Hum 10^6	8.42	8.42	8.42	8.42
PCB (Total)	CMC	0.0013	0.0013	0.0013	0.0013
	CCC	0.4200	0.4200	0.4200	0.4200
	Hum 10^6	159.49	159.49	159.49	159.49
Cadmium	CMC	0.0056	0.0056	0.0056	0.0056
	CCC	0.0258	0.0258	0.0258	0.0258
Chromium	CMC	0.0002	0.0002	0.0002	0.0002
	CCC	0.0050	0.0050	0.0050	0.0050
Copper	CMC	0.0552	0.0552	0.0552	0.0552
Mercury	CMC	0.0014	0.0014	0.0014	0.0014
	CCC	0.1144	0.1144	0.1144	0.1144
	Hum. T.	0.0196	0.0196	0.0196	0.0196
Nickel	CMC	0.0020	0.0020	0.0020	0.0020
	CCC	0.0394	0.0394	0.0394	0.0394
	Hum. T.	0.0028	0.0028	0.0028	0.0028
Selenium	CMC	0.0003	0.0003	0.0003	0.0003
	CCC	0.0021	0.0021	0.0021	0.0021
Silver	CMC	0.0039	0.0039	0.0039	0.0039
Zinc	CMC	0.0001	0.0001	0.0001	0.0001
	CCC	0.0004	0.0004	0.0004	0.0004
Cyanide	CMC	0.3000	0.3000	0.3000	0.3000

NOTES: CMC = Acute Aquatic Toxicity
CCC = Chronic Aquatic Toxicity
Hum. T. = Acute Toxicity in Humans
Hum 10^6 = Long-term mortality for 1:1,000,000 Humans

*** Dilution Requirements > 1.0 require corrective action ***

TABLE 7

Relative Contributions to Receiving Water Quality Degradation

OUTFALL LOCATION	SOURCE	Maximum Relative Concentrations at: Estuary	Inner H.	Outer H.	Diffuser
None	SRO	38	24	7	2
	SRO+CSO	71	44	11	4
Estuary	WWTP	43	21	6	2
	WWTP+SRO	80	45	12	4
	WWTP+SRO+CSO	112	64	17	6
Inner H.	WWTP	17	19	6	2
	WWTP+SRO	55	42	12	4
	WWTP+SRO+CSO	87	62	17	6
Outer H.	WWTP	5	5	5	2
	WWTP+SRO	43	29	12	4
	WWTP+SRO+CSO	75	44	16	5
Diffuser	WWTP	2	2	2	2
	WWTP+SRO	40	26	8	4
	WWTP+SRO+CSO	72	46	13	5

NOTE: WWTP Q = 47 cfs, concentration = 1000
SRO Q = 52 cfs, concentration = 4375 or 4125
CSO Q = 48 cfs, concentration = 4208 or 4127

(WWTP Q's and C's estimated from N.B. Industrial Pretreatment Plan; SRO/CSO Q's and C's estimated from N.B. CSO Phase I Report.)

George
no action
keep in NB files
3/31/87

MEMORANDUM

TO: KEVIN McSWEENEY
RON MANFREDONIA
TONY DE PALMA

FROM: DAVE GRAVALLESE

DATE: MARCH 27, 1987

SUBJ: NEW BEDFORD RECEIVING WATER MODELS

Today we received the attached letter from CDM requesting a meeting with EPA and DEQE concerning the receiving water models to be done for the City of New Bedford. The letter raises issues which appear to include permitting, NEPA and enforcement concerns. We should have the appropriate people review the letter, but I do not know who the appropriate people would be. I will check with each of you on this on Monday.

Thanks
Dave

Clyde
Steve S
are the appropriate people

Told Dave

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

One Center Plaza
Boston, Massachusetts 02108
617 742-5151

March 26, 1987

Mr. Alan Slater
Department of Environmental
Quality Engineering
Division of Water Pollution Control
One Winter Street
Boston, MA 02108

City of New Bedford
Development of
Receiving Water Models

Dear Mr. Slater:

As discussed, CDM has reviewed various receiving water computer models with regards to their applicability to the New Bedford project. We present below an overview of our findings and conclusions that we hope can be used to generate discussion between the City, CDM and the regulatory agencies on the best models to use.

After EPA's and the Division's review of this document, we request a meeting to discuss the regulatory agencies' comments. Before finalizing our approach, we need to know fully your explicit water quality requirements. As part of the final modeling scope, we feel it is imperative to list the potential water quality problems and concerns that the regulatory agencies want addressed. As presented below, model selection and applicability is dictated by the criteria stipulated by the standards and the agencies. We are obviously looking for guidance in this area. For example, when evaluating an outfall site, are the regulatory agencies mostly concerned with water column quality or trace contaminants in the sediments?

A. OBJECTIVES

1. Combined Sewer Overflows (CSO's)

Alternatives will be evaluated for the collection and treatment of CSO's which currently discharge into various segments of New Bedford Harbor and Clark's Cove. Each alternative will be evaluated for:

- o frequency of violations of coliform standards for
  - a) recreational facilities (bathing, fishing)
  - b) commercial fisheries (shellfish)
- o nonquantifiable standards (aesthetics)

2. Outfall Siting

A facilities plan for a new secondary treatment plant will be performed concurrently with the CSO study. As part of this study (Phase 2 Wastewater Treatment Facilities Plan), alternative ocean outfall locations will be evaluated in terms of their near- and far-field impacts.

Near-field (Zone of Initial Dilution) concerns include:

- o Initial dilution and plume physics/geometry
- o Water quality criteria for aquatic life at Zone of Initial Dilution
- o Sediment coagulation/precipitation and accumulation

Far-field concerns include:

- o Receiving water quality criteria at impacted locations of special interest: public beaches, shellfish beds, etc.
- o Special problems pertaining to ultimate fate of pollutant in water column and sediment fraction
- o Accumulation of sediment by coagulation or precipitation of dissolved/suspended matter in zones adjacent to and down-current from the outfall

Near field concerns are commonly evaluated with the aid of standard computer programs for the calculation of initial dilution. These program are published by the EPA for use in a variety of ocean outfall configurations.

Choice of a methodology for assessing far-field affects depends on resolution of the following issues:

- o Complexity of simulation for the New Bedford Harbor: 2-D or 3-D modeling?
- o Water quality constituents to be modeled: interacting conventional parameters, non-reacting toxics with first-order decay, or both?
- o Question of ultimate fate of pollutants: model final distribution of pollutants out of water column into existing sediment beds?
- o Question of accumulation of new sediment from effluent: model sediment build-up around new outfall sites (i.e,, creation of <u>new</u> sediments)?

B. AVAILABLE MODELING TOOLS

A variety of tools are available for evaluation of receiving water impacts for CSO's and ocean outfalls.

For evaluation of CSO impacts, where the issues are not well quantified, a more qualitative analysis geared toward solution of localized problems may be appropriate.

Siting of ocean outfalls and the evaluation of the complex issues involved may require the use of computer simulation techniques. Models currently available for use in the New Bedford project include:

1. Near-field Models

   o EPA Initial Dilution program ULINE

2. Far-field Models (increasing complexity/cost)

   o PACE
   o Hydrodynamics data with Modified PACE
   o Dynamic Estuary Model (DEM)
   o TEA/ELA
   o Battelle New Bedford Model

Highlights of each of these modeling alternative are appended in summary form.

C. TENTATIVE MODELING APPROACH

1. Combined Sewer Overflows

CSO mitigation alternatives will be evaluated by using the information contained in the existing base of field data and special studies on oceanic circulation patterns in and around New Bedford HArbor. These will be combined with the following characteristics of New Bedford CSO's:

o CSO quantity, quality and discharge durations will be described in statistical terms or total loadings using existing land-base models (STORM, SWIMM).

o No specific set of federal or state receiving water standards apply to CSO's. Each set of CSO outfalls curbed produces a different set of impacts, with local quality requirements determined by the uses of the particular receiving water.

Desktop evaluations involving mass balances, die-off/decay rates, and known circulation patterns at specific sites will be performed to evaluate receiving water impacts with and without the proposed CSO mitigation measures. No computer modeling will be performed for this task. Timing considerations permitting, the findings of an upcoming detailed study of Inner Harbor circulation by Woods Hole for Battelle's New Bedford modeling effort will be incorporated in conducting this study.

Our approach will be that when an overflow occurs, a receiving water violation will result. Detailed evaluations to quantify the extent of the violation will not be performed. The final analysis will be presented on a cost benefit basis: cost of CSO mitigation versus reduction in the number of water quality violations per year.

2. Outfall Siting

For outfall siting studies, federal receiving water standards at the Zone of Initial Dilution are well defined. Recent discussions by interested parties in the outfall siting studies for MWRA's Boston Harbor outfall have brought to light a score of new, complex, and hitherto unlegislated, issues.

The receiving water issues to be addressed in the outfall siting studies must be determined before the final selection of the modeling tool can be made. The number of issues and parameters to be modeled must be balanced against the high cost of collecting field data and running complex models.

Tentatively, we propose the following methodologies for outfall siting studies:

1. Near-field Studies

    o Use ULINE for initial dilution studies

2. Far-field Studies

    o Use modified PACE model using CDM, Battelle, or other source of field oceanographic data; PACE to be modified to meet study requirements

    - OR -

    o Couple Modified, 3-D version of PACE with output from the hydrodynamics module of Battelle's New Bedford Model (or similar model)

If ultimate fate and dispersal of pollutants into sediment fraction is to be modeled, Battelle's New Bedford model will be run using all its sedimentation options. Use of this model, with its high associated costs, will curtail the number of alternatives to be evaluated.

We trust that the above can form the basis for open discussions among the parties involved. We look forward to receiving your thoughts and comments.

Very truly yours,

CAMP DRESSER & McKEE INC.

Stephen J. Hickox
Vice President

SJH/rar
cc: Mr. Ben Baker
Ms. Marcy Wetherbee
Dave Gravallese - EPA
Paul Hauge - CLF

File: 309-134-RT-GEAD/22

BATTELLE'S NEW BEDFORD MODEL

PROS:

- o 3-D model with extremely fine grids, models flow reversals, etc.
- o Can track toxic constituent fate processes:
  - volatilization
  - adsorption/desorption
  - settling and scouring
  - advection and dispersion.
- o Can also model dissolved constituent (tracking).
- o Should be fully calibrated and ready to run; all costs incremental.

CONS:

- o Very complex, requires Cray XMP computer.
- o Can model only single constituent per run.
- o Cannot model water quality parameters (DO/BOD, algae/nutrients) or coagulation.
- o High cost per run.
- o Runs made in West Coast (CA or WA); long turnaround times likely.

MIT'S TEA/ELA*

PROS

- o TEA: MIT, 2-D, vertically integrated, finite-element, frequency domain, circulation model.

  ELA: MIT, 2-D, vertically integrated, finite-element mass transport model,"puff" tracking algorithm, first order die-off rates for fate processes.

- o Use TEA to set up hydraulics of the estuarine system, then use ELA to track pollutant fate.

- o Runs made at MIT or CDM, quick turnaround times.

- o Relatively low run costs.

CONS:

- o 2-D vertically integrated model — cannot simulate stratified flows.

- o Must set up and calibrate model from scratch.

- o Single constituent only, first order "decay".

- o Coagulation not modeled.

* - TEA : Tidal Embayment Analysis
- ELA : Eulerian-Lagrangian Analysis

HYDRODYNAMICS + MODIFIED PACE

PROS:

- o Link CDM's Modified PACE particle tracking model to output from hydrodynamics module of Battelle's New Bedford Model or other source of similar data (e.g., field studies).
- o See PACE description page for PRO's of using PACE.
- o Minimum number of Battelle or other model runs.
- o Little or no calibration for Modified PACE.
- o All PACE runs at CDM, quick turnaround time.

CONS:

- o Modified PACE currently not operational. Modification scheduled for spring start.
- o Must in turn convert Modified PACE to include 3-D capabilities (vertical fluxes, etc.) and add coagulation routine.
- o No interacting water quality parameters modeled.
- o Only first order decay rate at present.

DYNAMIC ESTUARY MODEL (DEM)

PROS:

- o Link-node model developed by CDM.
- o Can model interacting water quality parameters:
  - BOD/DO
  - algae/nutrients/sunlight
  - dissolved constituents
- o All runs made at CDM, quick turnaround time.
- o May be least expensive model to run.

CONS:

- o Vertically averaged model, cannot model general case of stratified flows.
- o Can, however, approximate stratified flows in shipping channels using multiple links between adjacent nodes.
- o Less suited for single-constituent tracking/fate cases.
- o Must set up and calibrate from scratch.

PACE

PROS:

- o Particle Advection and Cumulative Exceedence (PACE) model developed by CDM for far-field studies.
- o Uses direct current meter measurements to assess circulation and sedimentation patterns.
- o Can be adapted to using grid-interpolated/simulated current velocity field as input.
- o Can specify fall velocity for sedimentation assessment.
- o Used to estimate:
  - water column average concentrations
  - cumulative plume presence
  - cumulative criterion exceedence
  - sedimentation by particles and concentrations
- o Can interface with CDM's DYNPLOT graphics program.
- o Relatively low run costs and quick turnaround times.

CONS:

- o Must obtain, collate, interpret, and interpolate field data collected by Battelle, CDM, or others.
- o Does not model interacting water quality parameters.
- o Does not model coagulation; routine must be added.
- o Currently awaiting enhancement to accept two-dimensional flow field data output by external hydrodynamic circulation model.

ULINE

PROS

- o Developed by EPA, used for calculating dilutions in Zone of Initial Dilution (ZID) at ocean outfall sites.
- o In CDM's opinion yields the most realistic results of several EPA initial dilution models.
- o Can test diffuser configurations under various ambient seawater conditions.
- o Currently in use at CDM.

CONS:

- o Models conditions at ZID (near field) only. Must use other models for far field studies.
- o Simple dilutions only; no water quality interactions.

EXHIBIT B

CDM

environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.

One Center Plaza
Boston, Massachusetts 02108
617 742-5151

March 26, 1987

Mr. Alan Slater
Department of Environmental
Quality Engineering
Division of Water Pollution Control
One Winter Street
Boston, MA 02108

City of New Bedford
Development of
Receiving Water Models

Dear Mr. Slater:

As discussed, CDM has reviewed various receiving water computer models with regards to their applicability to the New Bedford project. We present below an overview of our findings and conclusions that we hope can be used to generate discussion between the City, CDM and the regulatory agencies on the best models to use.

After EPA's and the Division's review of this document, we request a meeting to discuss the regulatory agencies' comments. Before finalizing our approach, we need to know fully your explicit water quality requirements. As part of the final modeling scope, we feel it is imperative to list the potential water quality problems and concerns that the regulatory agencies want addressed. As presented below, model selection and applicability is dictated by the criteria stipulated by the standards and the agencies. We are obviously looking for guidance in this area. For example, when evaluating an outfall site, are the regulatory agencies mostly concerned with water column quality or trace contaminants in the sediments?

A. OBJECTIVES

1. Combined Sewer Overflows (CSO's)

Alternatives will be evaluated for the collection and treatment of CSO's which currently discharge into various segments of New Bedford Harbor and Clark's Cove. Each alternative will be evaluated for:

- frequency of violations of coliform standards for
  a) recreational facilities (bathing, fishing)
  b) commercial fisheries (shellfish)
- nonquantifiable standards (aesthetics)

2. Outfall Siting

A facilities plan for a new secondary treatment plant will be performed concurrently with the CSO study. As part of this study (Phase 2 Wastewater Treatment Facilities Plan), alternative ocean outfall locations will be evaluated in terms of their near- and far-field impacts.

Near-field (Zone of Initial Dilution) concerns include:

- Initial dilution and plume physics/geometry
- Water quality criteria for aquatic life at Zone of Initial Dilution
- Sediment coagulation/precipitation and accumulation

Far-field concerns include:

- Receiving water quality criteria at impacted locations of special interest: public beaches, shellfish beds, etc.
- Special problems pertaining to ultimate fate of pollutant in water column and sediment fraction
- Accumulation of sediment by coagulation or precipitation of dissolved/suspended matter in zones adjacent to and down-current from the outfall

Near field concerns are commonly evaluated with the aid of standard computer programs for the calculation of initial dilution. These program are published by the EPA for use in a variety of ocean outfall configurations.

Choice of a methodology for assessing far-field affects depends on resolution of the following issues:

- Complexity of simulation for the New Bedford Harbor: 2-D or 3-D modeling?
- Water quality constituents to be modeled: interacting conventional parameters, non-reacting toxics with first-order decay, or both?
- Question of ultimate fate of pollutants: model final distribution of pollutants out of water column into existing sediment beds?
- Question of accumulation of new sediment from effluent: model sediment build-up around new outfall sites (i.e., creation of new sediments)?

B. AVAILABLE MODELING TOOLS

A variety of tools are available for evaluation of receiving water impacts for CSO's and ocean outfalls.

For evaluation of CSO impacts, where the issues are not well quantified, a more qualitative analysis geared toward solution of localized problems may be appropriate.

Siting of ocean outfalls and the evaluation of the complex issues involved may require the use of computer simulation techniques. Models currently available for use in the New Bedford project include:

1. Near-field Models

   o EPA Initial Dilution program ULINE

2. Far-field Models (increasing complexity/cost)

   o PACE
   o Hydrodynamics data with Modified PACE
   o Dynamic Estuary Model (DEM)
   o TEA/ELA
   o Battelle New Bedford Model

Highlights of each of these modeling alternative are appended in summary form.

C. TENTATIVE MODELING APPROACH

1. Combined Sewer Overflows

CSO mitigation alternatives will be evaluated by using the information contained in the existing base of field data and special studies on oceanic circulation patterns in and around New Bedford HArbor. These will be combined with the following characteristics of New Bedford CSO's:

- o CSO quantity, quality and discharge durations will be described in statistical terms or total loadings using existing land-base models (STORM, SWIMM).

- o No specific set of federal or state receiving water standards apply to CSO's. Each set of CSO outfalls curbed produces a different set of impacts, with local quality requirements determined by the uses of the particular receiving water.

Desktop evaluations involving mass balances, die-off/decay rates, and known circulation patterns at specific sites will be performed to evaluate receiving water impacts with and without the proposed CSO mitigation measures. No computer modeling will be performed for this task. Timing considerations permitting, the findings of an upcoming detailed study of Inner Harbor circulation by Woods Hole for Battelle's New Bedford modeling effort will be incorporated in conducting this study.

Our approach will be that when an overflow occurs, a receiving water violation will result. Detailed evaluations to quantify the extent of the violation will not be performed. The final analysis will be presented on a cost benefit basis: cost of CSO mitigation versus reduction in the number of water quality violations per year.

2. Outfall Siting

For outfall siting studies, federal receiving water standards at the Zone of Initial Dilution are well defined. Recent discussions by interested parties in the outfall siting studies for MWRA's Boston Harbor outfall have brought to light a score of new, complex, and hitherto unlegislated, issues.

The receiving water issues to be addressed in the outfall siting studies must be determined before the final selection of the modeling tool can be made. The number of issues and parameters to be modeled must be balanced against the high cost of collecting field data and running complex models.

Tentatively, we propose the following methodologies for outfall siting studies:

1. Near-field Studies

   o Use ULINE for initial dilution studies

2. Far-field Studies

   o Use modified PACE model using CDM, Battelle, or other source of field oceanographic data; PACE to be modified to meet study requirements

   - OR -

   o Couple Modified, 3-D version of PACE with output from the hydrodynamics module of Battelle's New Bedford Model (or similar model)

If ultimate fate and dispersal of pollutants into sediment fraction is to be modeled, Battelle's New Bedford model will be run using all its sedimentation options. Use of this model, with its high associated costs, will curtail the number of alternatives to be evaluated.

We trust that the above can form the basis for open discussions among the parties involved. We look forward to receiving your thoughts and comments.

Very truly yours,

CAMP DRESSER & McKEE INC.

Stephen J. Hickox
Vice President

SJH/rar
cc: Mr. Ben Baker
Ms. Marcy Wetherbee
Dave Gravallese - EPA
Paul Hauge - CLF

File: 309-134-RT-GEAD/22

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- Must set up and calibrate from scratch.

MIT'S TEA/ELA*

PROS

- TEA: MIT, 2-D, vertically integrated, finite-element, frequency domain, circulation model.

  ELA: MIT, 2-D, vertically integrated, finite-element mass transport model,"puff" tracking algorithm, first order die-off rates for fate processes.

- Use TEA to set up hydraulics of the estuarine system, then use ELA to track pollutant fate.
- Runs made at MIT or CDM, quick turnaround times.
- Relatively low run costs.

CONS:

- 2-D vertically integrated model — cannot simulate stratified flows.
- Must set up and calibrate model from scratch.
- Single constituent only, first order "decay".
- Coagulation not modeled.

* - TEA : Tidal Embayment Analysis
  - ELA : Eulerian-Lagrangian Analysis

BATTELLE'S NEW BEDFORD MODEL

PROS:

- o 3-D model with extremely fine grids, models flow reversals, etc.
- o Can track toxic constituent fate processes:
  - volatilization
  - adsorption/desorption
  - settling and scouring
  - advection and dispersion.
- o Can also model dissolved constituent (tracking).
- o Should be fully calibrated and ready to run; all costs incremental.

CONS:

- o Very complex, requires Cray XMP computer.
- o Can model only single constituent per run.
- o Cannot model water quality parameters (DO/BOD, algae/nutrients) or coagulation.
- o High cost per run.
- o Runs made in West Coast (CA or WA); long turnaround times likely.

New Bedford 2/5/87

Congressional briefing Monday Ron, Larry, Kevin

Boston MWRA and New Bedford linked

Boston will go first, prob ~~next Tues~~ one wk maybe two

3 Boston issues not denied - toxics

~~right to implement toxics~~

throwing out all others.

→ City serious about biomonitoring and PCBs in appeal

CDM
environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

One Center Plaza
Boston, Massachusetts 02108
617 742-5151

November 20, 1986

Mr. David Gravallese
Environmental Protection Agency
Region 1
Boston, MA 02108

New Bedford Modeling Information

Dear Mr. Gravallese:

As CDM has discussed with EPA in the past, to perform facilities planning work in the New Bedford area regarding wastewater and stormwater, specific information regarding past efforts on modeling New Bedford's receiving water would enhance efficiency and move the project expeditiously. The information we seek concerns the entire modeling process including details of the modeling tool and -- most importantly -- the data and procedures regarding how various parameters were established and how calibration was insured.

In order to permit CDM to formulate the specific questions for which we seek answers, it would be useful to permit one or perhaps two CDM experts to examine any documentation or reports regarding the New Bedford modeling work. We understand that this information is sensitive and involved in CERCLA enforcement proceedings and we will therefore treat it confidentially. We would also welcome the opportunity to talk with those who performed the modeling work. Based on a review and/or discussion, CDM will be in a better position to make specific information requests.

In general, at this point in time, the information CDM seeks regarding the modeling efforts can be characterized as follows:

- What specific modeling tool was employed? Is there public domain documentation for the model and/or is there a basic reference in the literature?
- Does the model operate in two or three dimension?
- Does the model employ finite difference or finite element solution techniques?
- At what spatial scale was the model operated? (What was the study area included in the modeling exercise?)

- What data was gathered or used for establishing hydraulic and dispersive properties of the receiving waters?

- What data was used to establish boundary conditions and forcing functions?

- What data sets were gathered and used for calibration and verification purposes?

We thank EPA for their consideration in this matter. Again, we stress that a meeting between CDM experts and those who applied the modeling tool in New Bedford would be useful. Also, a confidential review of documentation regarding the modeling effort would quickly provide the answers to our general questions. Of course, more specific questions might follow from this basic understanding.

Please give me a call if you want to set up a meeting. If your technical staff needs further information, please have them call Dr. Myron Rosenberg directly.

Very truly yours,

CAMP DRESSER & McKEE INC.

Stephen J. Hickox
Vice President

SJH:jd

File: 112 MW/5616-55